

concrete construction

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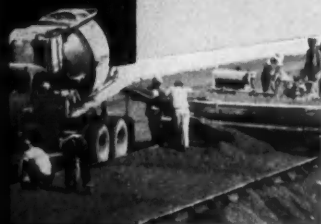
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20 RADIO EASES SUPERVISION PROBLEM

Long familiar with the use of two-way radio as a means of expediting delivery of ready mixed concrete, contractors are finding that modern communications can play an important role in their own operations.





Users of Concrete Will Benefit

We'd like to use our space this month to offer congratulations to the Associated General Contractors of America, the National Ready Mixed Concrete Association and the National Sand and Gravel Association for still another evidence of the vigorous leadership which these fine organizations are providing their memberships. We have reference to the formation of a National Joint Co-operative Committee through which these three associations will in the future facilitate the discussion of problems which are common to the important industries which they represent.

We believe that much good can be accomplished by such a committee, and that its creation is consistent with all of the best traditions of the construction industry. By the very fact that it must necessarily coordinate the efforts and abilities of many unrelated organizations, construction is a tough, exacting and challenging business. There has always been a need for better coordination of effort and for better lines of communication, and this need is clearly on the increase today as the complexity and magnitude of the projects we undertake are multiplied again and again.

By moving forthrightly into this area in behalf of their three great industries, the Associated General Contractors, the National Ready Mixed Concrete Association and the National Sand and Gravel Association are undertaking a task of no small proportions. There are frictions, misunderstandings and sometimes head-on collisions to be dealt with, reconciled and eventually averted insofar as it is humanly possible to do so.

But if the task is difficult, the rewards can be and will be commensurately great. No one, at any rate, can doubt that these closely interworking industries are firmly resolved to unite their abilities, resources and know-how to the end that all users of concrete shall benefit.

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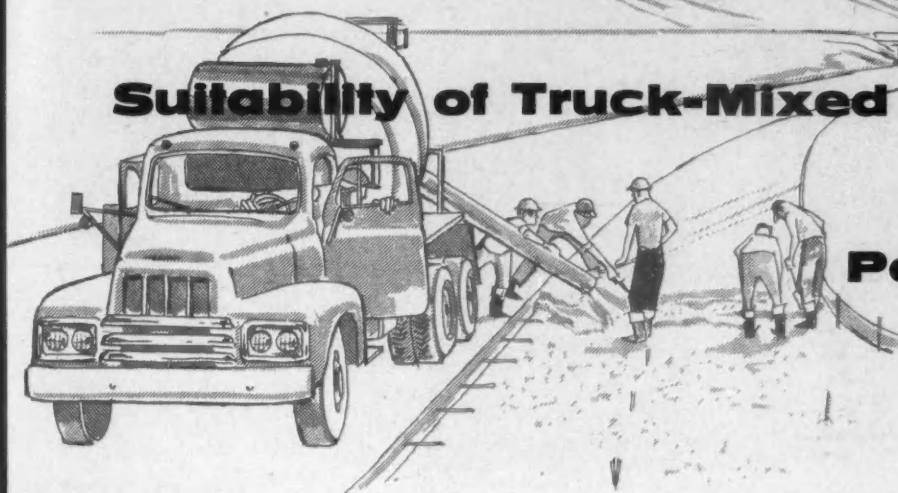
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Suitability of Truck-Mixed Concrete for Pavements



BY ALBERT G. TIMMS*

THE OBJECTIONS most commonly raised by Federal, State, and municipal organizations to the use of truck mixers for making pavement-type concrete were examined in the first article of this series. As pointed out, the most serious one has been the claim that it is difficult to control the consistency of the concrete. Suggestions for overcoming this objection, based on recent research, should be of assistance to ready mix operators who may wish to enter the paving field, as well as to engineers and contractors who wish to avail themselves of the many fine advantages of ready mixed concrete. It must be kept in mind that Federal or State paving projects impose more restrictions and require more rigid inspections than are normally encountered on other types of construction.

plant facilities

Before letting contracts, some States may wish their engineers to inspect and approve the ready mix plant facilities to determine fitness for maintaining the control of quality as well as capacity for producing the quantity required for daily operation. Many of the states oppose batching concrete material for pavements from the same equipment as is being used for batching concrete for other construction. They prefer that batching equip-

ment and mixers be used only for the specified paving job, and that all materials be kept separate from those being used for other projects—first, because it is important to prevent delay in the even flow of concrete to the job, and second, because of the danger of mix-ups in the batches.

A ready mix plant would probably be required to set aside a separate cement storage silo for a given pavement project. Some States specify pretested portland cement and do not allow this special cement to be used for other purposes because of the extra testing costs. They may also require the cement to be certified and sealed to prevent substitutions. From the lessons learned during the cement shortage of 1956-1957, there will likely be increased emphasis on insuring adequate cement storage for highway work both at the cement manufacturers' plants and at the batching plants. When the aggregate supply is also pretested and reserved for highway work, the ready mix operator may well look into the economy of a separate plant for producing highway concrete, although this would obviously necessitate a large volume of work.

This discussion of plant facilities may appear to be far afield from the question: can truck mixers deliver satisfactory low-slump concrete? In the opinion of some engineers who have studied the problem, any failure to control the quality of truck-mixed concrete has been caused by (1) inadequate control of water content; (2) failure to maintain uniform size, grad-

ing, and moisture content of the aggregates; or (3) the adverse effects of certain sequences of loading. These are all batching plant problems and have nothing to do with the fundamental ability of the majority of truck mixers to mix and discharge low-slump concrete.

control of materials

Cement—The batching of the cement will receive very close inspection since it is essential that a full measure of cement be present in each and every batch. The majority of States require a separate weighing hopper for the cement.

Aggregates—In the sizing and grading of the aggregates, fluctuation must be kept to a minimum if uniformity in the quality of the concrete is to be obtained. No matter how perfect the operation of the truck mixer, successive batches of concrete will not be uniform unless the aggregate as delivered to the trucks is reasonably consistent in size and grading. This fact is emphasized in Publication No. 44, *Control of Quality of Ready Mixed Concrete*, of the National Ready Mixed Concrete Association.

By handling aggregates in closely graded sizes, segregation can be minimized. The principal problem is presented by the coarse aggregate. The maximum size is usually about 2 inches for pavement concrete; the higher the percentage of large aggregate, the more susceptible it is to segregation and breakage in stockpiling. The larger pieces break more

*Consulting Engineer on concrete problems. Formerly assistant manager, Research Laboratory of the Portland Cement Association; more recently Head of the Concrete and Miscellaneous Unit of the Physical Research Branch of the Federal Bureau of Public Roads.



courtesy of National Ready Mixed Concrete Association

The low-slump concrete required in specification paving work simply will not flow from one point to another. Here workmen are using shovels to spread stiff concrete as it falls from the discharge chute of a ready mix truck.



These two photographs demonstrate what can happen when insufficient attention is given to thorough mixing and method of discharge. The top view shows the stony discharge at the end of a batch which was intentionally undermixed. The bottom view is an example of the separation which can take place between mortar and coarse aggregate when a batch is improperly discharged.



easily than the pieces below 1 inch. Aggregate should be handled as few times as possible, not only because of segregation but also because of breakage.

The general use of 2-inch maximum size aggregate is based on the need of less mixing water for a given consistency than is required when using smaller size aggregate. However, this so-called advantage is theoretical rather than real. Since smaller maximum-size aggregate is more uniform, its use results in concrete that has more workability for a given consistency than does the use of larger sizes. This, in turn, tends to make the finished concrete more uniform. In European countries smaller maximum size aggregate (approximately 1 inch) is nearly always used.

In the opinion of a number of investigators of highway materials, a smaller maximum size coarse aggregate would be of decided advantage in maintaining uniformity of the quality of the final pavement. This certainly would be an advantage in truck-mixed concrete because it would permit a wider variation in the number of revolutions required for adequate mixing. However, it is not expected that any change will be made in Federal and State specifications in the near future.

Mixing Water—It cannot be over-emphasized that lack of adequate control of mixing water is the most frequent cause of non-uniformity in the consistency of successive batches of concrete. The availability of proper facilities for determining and compensating for variations in moisture content of the aggregates is absolutely essential.

Aggregates should be handled in such a manner that the moisture content is reasonably uniform and sudden fluctuations do not occur. This precaution greatly simplifies the problem of water control, particularly when electrical moisture meters are relied upon to give an accurate measure of moisture in the aggregate.

Whenever practicable, mixing water should be completely controlled at the batching plant. The required amount of water should be placed in the mixer drum before the truck leaves the plant. However, this procedure will result in uniformity of consistency or slump only when the amount of moisture in the aggregate has been accurately compensated for.

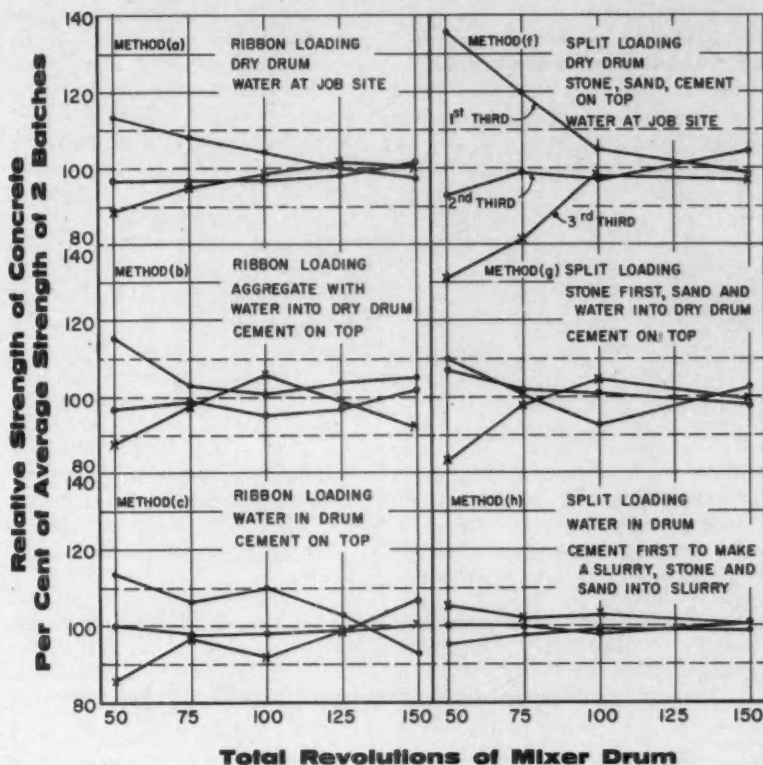
method of loading

The sequence used in charging the mixer drum is of very great importance in determining the number of revolutions required to obtain adequate mixing of the concrete. Ribbon loading (that is, the simultaneous loading of the cement, aggregates, and water) provides rapid loading and contributes to the mixing, and requires fewer revolutions of the mixer drum. Equally good results are obtained when the dry materials are ribbon loaded into the mixing water, which has previously been put in the drum.

However, this ideal method cannot be used in certain cases where there are restrictions imposed by specifications or length of haul. Ribbon loading cannot be used when there will be a time lapse between the intermingling of aggregates and cement and the beginning of the mixing. When the time between batching and mixing is likely to be very long, it has been the practice to load the aggregates first and then batch the cement on top. With the larger rated loads now permitted, however, this procedure is likely to cause spillage of the cement in inclined-axis truck mixers unless special mechanical means are employed to get the cement up to the front of the drum.

In split loading (that is, when the dry materials are added separately) it is desirable when at all possible to put the mixing water into the drum ahead of the aggregates. Under no condition should the sand be put in the mixer ahead of the coarse aggregate because it will pack in the head of the inclined-axis truck mixers and be discharged unmixed with the other ingredients.

FIGURE 1: Effect of amount of mixing on relative strength of non-air-entrained concrete with 4½ cubic yard load for different batching conditions.



speeds for mixing and agitating

Specifications limit the rate of mixing and the rate of agitation according to the size of truck mixers and agitators. Speed for the revolving drum type agitator is usually within the limits of not less than 2 nor more than 6 rpm. Unless the engines are in excellent condition, it is difficult to hold the low speeds of 2 to 6 rpm without stalling. This difficulty is probably becoming less serious with the growing use of multiple-speed power take-offs, as well as with the increasing use of fluid couplings when separate engines are employed.

Speeds for truck mixers range from 7 to 12 rpm. In tests conducted by the National Ready Mixed Concrete Association² it was found that for capacity batches mixed in comparable sized mixers, there was essentially no variation in strength levels due to changes in rate of mixing, except for harsh concrete in one of the mixers.

²Tests of Concrete Truck Mixers, by Stanton Walker and D. L. Bloom, Publication No. 50, National Ready Mixed Concrete Association, 1954; Washington, D. C.

In the exception there was a significant increase in strength at the higher rate.

Tests conducted at the Worthington Corporation plant³ showed that for the same amount of mixing there was little difference between the strengths of the concrete mixed at 7 and at 10 rpm. The rate of mixing appeared to have little effect on segregation of the ingredients.

Speeds of 7 to 12 rpm generate more heat and cause more grinding than the lower agitator speeds. The heat promotes evaporation of the mixing water. This loss of water plus the added water requirements of the fines produced by grinding causes the batch to stiffen more quickly. It is therefore important to mix successive batches on a project at the same speed.

mixing time

The time of mixing is expressed as the number of revolutions of the drum.

³Tests on the Performance of Concrete Truck Mixers, by Albert G. Timms, Publication No. 78, National Ready Mixed Concrete Association, 1958; Washington, D. C.

Most States specify a minimum number. In order to insure the correct amount of mixing, most States further require that truck mixers be equipped with devices for counting or for verifying the number of revolutions of the drum.

From their tests of truck mixers, Walker and Bloem concluded that a minimum of 50 and a maximum of 100 revolutions at a constant mixing speed are conservative limits. But they suggest that when mixers are loaded to capacity, the minimum amount of mixing should be increased to 70 revolutions as a precautionary measure. The tests carried out by the author for the Worthington Corporation are in general agreement with Walker and Bloem except for certain split loading conditions.

Figure 1 shows the combined effect of method of loading and number of revolutions of the drum on the relative strengths of the concrete. It will be noted that 100 revolutions were

required to give the uniformity desired with split loading when the water was added at the job site (method f). The uniformity as far as strength is concerned was also very good for the split loading using a slurry mix (method h). However, further tests of the latter method of loading showed considerable segregation of the aggregate. One hundred and fifty revolutions of the drum were required to overcome this segregation.

As stated earlier, the higher mixing speeds (7 to 12 rpm) accelerate the rate of stiffening of the concrete, because of the considerable grinding action which takes place, as well as because of the generation of heat. Therefore it is equally important to regulate the total number of revolutions of the drum. By maintaining a constant rate and time of mixing, we can be reasonably certain of producing thoroughly mixed concrete with a consistency which is uniform from batch to batch.

discharge time

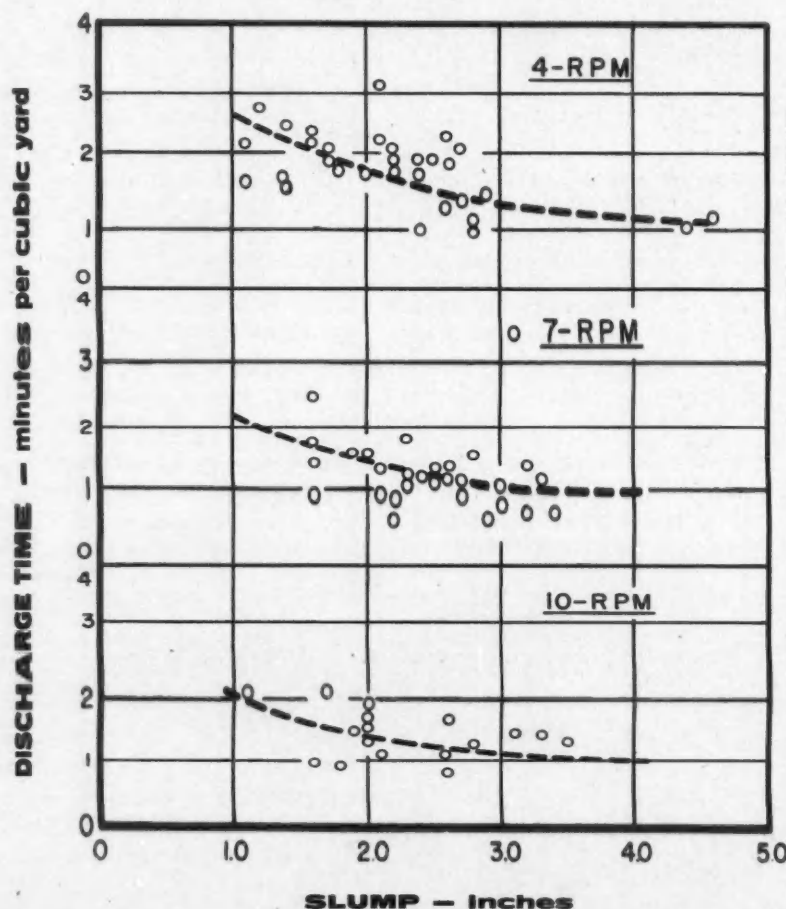
It takes longer to discharge concrete with a slump of less than 3 inches—the usual consistency required for paving. The diagrams in figure 2 show the effect of rate of mixing on discharge time for concretes of different slumps. While mixers of different make varied slightly in rates of discharge, they all showed the same general effect of requiring a little more time for discharging concrete with slumps below 3 inches.

The tests in general showed that pavement type concrete of uniform consistency as measured by slump tests (less than 2 inches) can be produced readily in truck mixers within the usual time limits.

The third and final installment of this series will discuss special problems such as discharge procedures and cold weather and hot weather precautions. A summary of recommended practices for ready mixed concrete for pavements will also be included.

'Performance Tests of Concrete Truck Mixers, by Albert G. Timms, Proceedings of the American Society for Testing Materials, 1957, page 1012.

FIGURE 2: Relationship between discharge time and consistency of the concrete as measured by slump.



**To be concluded
in the March issue**

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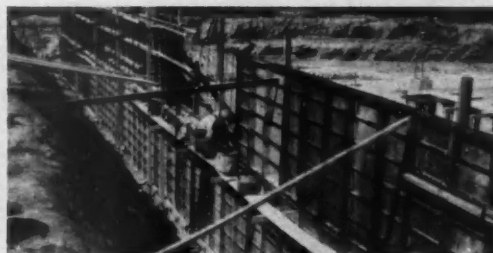
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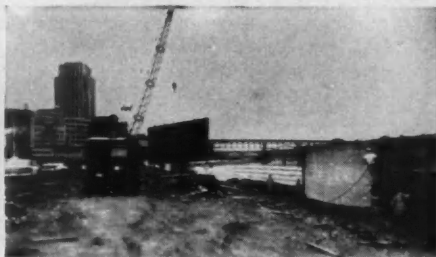
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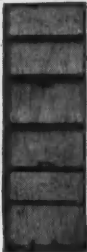
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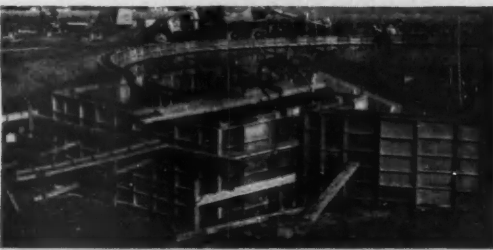
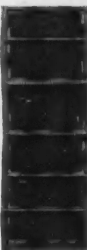
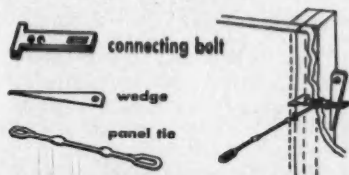


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This photo shows the beam concrete of the Wolcott Avenue Bridge at Hartford, Connecticut, being revibrated just before the concrete for the deck was placed.

REVIBRATION PRODUCES BETTER CONCRETE

BY C. A. VOLLICK¹

SUCCESSFUL APPLICATION of revibration in the construction of tankers and cargo ships during World War II has been described a number of times,² and this same procedure has also been satisfactorily used on some dry docks and piers where watertightness was considered essential. Additional evidence has accumulated which confirms these results and indicates that revibration will improve many of the qualities of hardened concrete. Increased consolidation is desirable where greater watertightness, improved appearance of formed surfaces, higher compressive strength, and greater density are

considered to be desirable.

Revibration does not reduce the durability of air-entrained concrete and the importance of using air-entrained concrete wherever increased durability is required should not be overlooked.

Revibration has been credited with increasing the density of concrete needed as a reactor shield. The testing laboratory was requested to design concrete with a plastic weight of 155 pounds per cubic foot without the use of heavyweight aggregates. Several different materials were tried and a densifying admixture was used in two trial batches. Three hours after casting, cylinders were revibrated and the density was found to increase 1 pound per cubic foot.

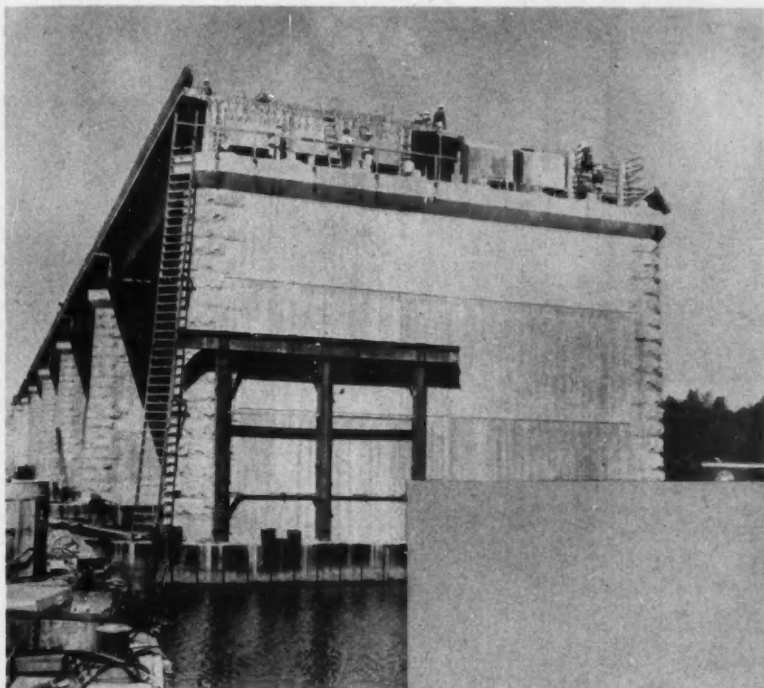
It is claimed that revibration and

the use of a retarding admixture in the concrete were responsible for successfully combining the beams and deck spans of the Wolcott Avenue bridge at Hartford, Connecticut, into a monolithic structure. The engineers estimated that the bridge could be cast in place at the same cost as a conventional prestressed concrete structure made up of precast T beams, and construction time could be reduced to a considerable extent. The adopted plan provided for construction of each 120-foot span in two separate parts, each 33 feet 10 inches wide. Each part of the span was cast as one continuous unit and four 7-foot deep girders were cast integrally with the deck.

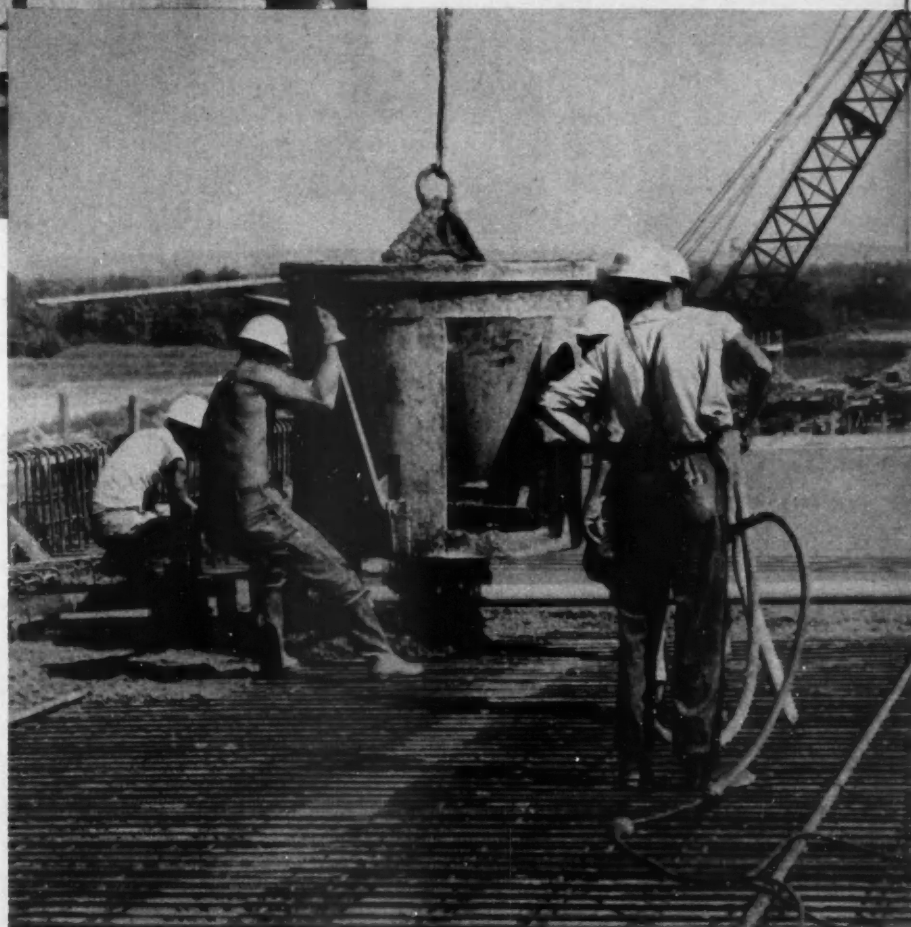
A densifying admixture was incorporated in the concrete in order to keep it plastic during the entire con-

¹Research Engineer, Sika Chemical Corporation, Passaic, N. J.

²See "A New Look at Revibration," Concrete Construction, September 1956, page 2.



The 7-foot deep prestressed beams and deck of the Wolcott Avenue Bridge at Hartford, Connecticut were cast as one unit by means of revibration. The concrete for the beams was placed in the morning, and revibrated just before and then again during the placing of the deck concrete in the afternoon. As the inset shows, the concrete deck is placed and vibrators inserted through the slab into each of the deep beams to a depth of 6 inches, assuring a monolithic beam and slab construction.



creting operation and thus weld the beams and slab into a monolithic structure. Excessive stress, and consequent cracking of the web as deflection occurred, were also avoided by keeping the concrete plastic until the entire 240 cubic yards of concrete was placed.

The beams were cast in 3-foot lifts and after placing each succeeding lift the concrete was revibrated by allowing the vibrator to penetrate to the bottom of the forms. Approximately $\frac{1}{2}$ inch consolidation was reported. Concrete in the beams was still plastic when the deck was placed. Vibrators were inserted through the fresh deck concrete about 12 inches into the beams and thus combined the lifts into one monolith.

Controlled tests designed to measure

The effect of revibration on the compaction and appearance of concrete is dramatically revealed by this series of photographs taken through a clear glass window in the side of a wooden box filled with fresh concrete.

Appearance of Concrete Before Vibration



Initial Vibration (40 Seconds)



Revibration at 1 Hour (20 Seconds)

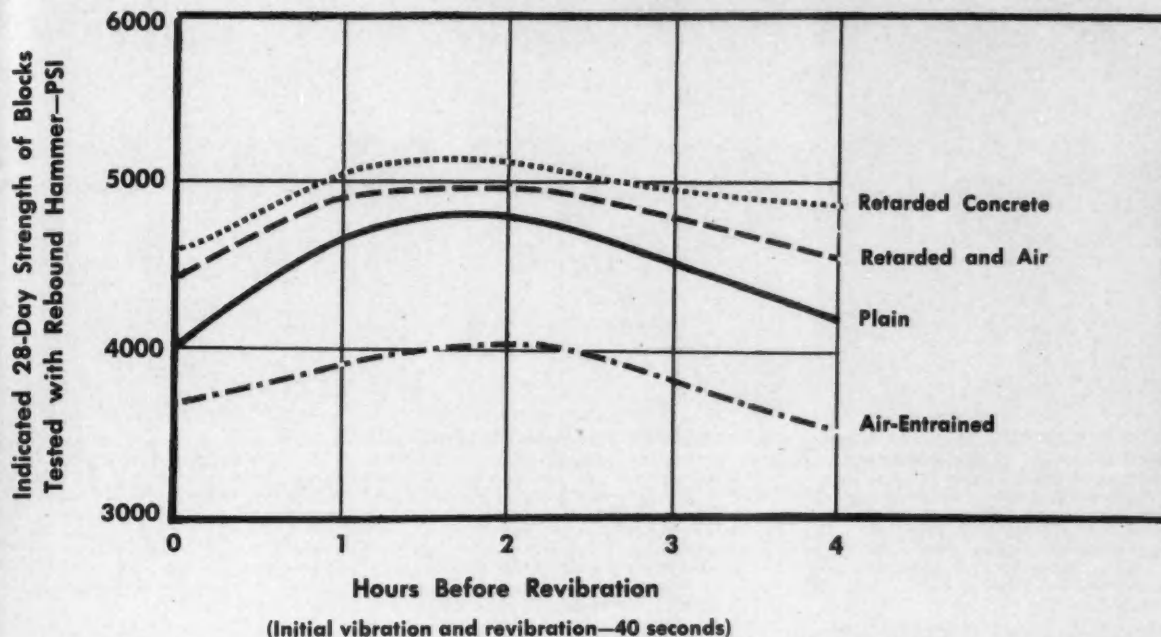


Second Revibration at 2 Hours



Third Revibration at 3 Hours

Effect of Revibration on Strength Indicated by Rebound Hammer (1 x 1 x 2-foot Blocks)



some of the effects of revibration have been performed in the laboratory of Sika Chemical Corporation. Laboratory mixed concrete containing $4\frac{1}{2}$ and $5\frac{1}{2}$ sacks of cement per cubic yard and ready mixed concrete containing 6 sacks of cement per cubic yard were investigated. The investigation included tests of plain, air-entrained, and retarded concrete, and also included tests of mixtures containing both air-entraining and retarding admixtures.

The concretes were given an initial vibration of 20 seconds and were revibrated an additional 20 seconds after delays of 1, 2, 3 and 4 hours. Results obtained with the revibrated concrete were compared with similar concrete vibrated 40 seconds initially, but not revibrated. Tests of hardened concrete were performed on blocks measuring 1 by 1 by 2 feet as well as on 6- by 12-inch cylinders.

The tests indicated that revibration produces higher compressive strength than the same amount of initial vibration. Maximum strength increase of 6- by 12-inch cylinders varied from 8.5 percent to 17.1 percent and averaged 14.0 percent for the mixes containing $4\frac{1}{2}$ sacks of cement per cubic yard. Maximum strength increase of the $5\frac{1}{2}$ -sack mixes varied from 6.9

percent to 18.7 percent and averaged 13.7 percent.

Indicated strength of the 1- by 1- by 2-foot blocks was determined with the impact hammer when the blocks were 28 days old. Maximum increase in strength resulting from revibration varied from 8.9 to 22.5 percent and averaged 13.9 percent.

The tests also showed that revibration improves the appearance of concrete surfaces. Initial vibration consolidated the concrete and removed many of the water and air voids appearing against the surface. After the vibrator was removed, water again began to collect in the voids remaining against the surface. Revibration 1 hour later removed some of the entrapped water and improved the appearance of the concrete. Additional revibration after 2 and 3 hours improved the appearance of the concrete even more.

Hardening time was not significantly influenced by revibration. The concrete became more plastic immediately after revibration, but the time required to reach final set was the same for revibrated concrete and concrete vibrated only once initially.

Additional bleed water was released by revibration. Increase in bleeding appeared to be accompanied by in-

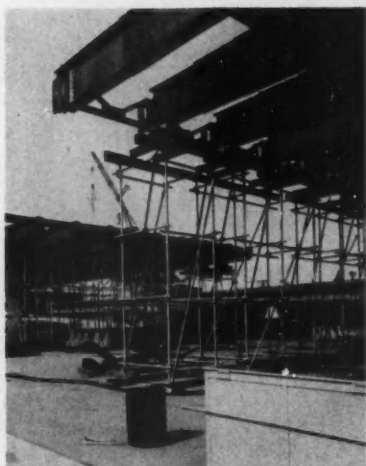
crease in compressive strength. In general, delay in revibration that resulted in maximum bleeding also resulted in maximum increase in compressive strength.

Retarded concrete remained plastic much longer than plain or air-entrained concrete and delay between placement and revibration could be increased. Maximum strength of plain and air-entrained concrete was obtained when the concrete was revibrated approximately 2 hours after placing. Delay between placement and revibration of retarded concrete was less critical, and the retarder improved the compressive strength of plain or air-entrained concrete revibrated at any period after placing.

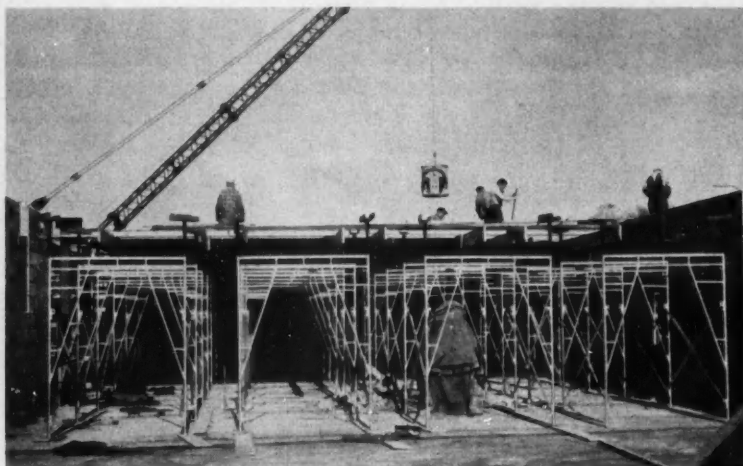
Concrete will benefit from revibration at any time provided the concrete is sufficiently plastic to permit the running vibrator to sink of its own weight. If vibration is slighted during the rush and confusion that often occurs when concrete is placed, deficiencies can be corrected by revibration. After the trucks and concrete crews have moved on, the vibrator man can methodically revibrate the concrete without haste. Revibration thus provides additional insurance that the concrete will be properly consolidated and free of honeycomb. END

Shoring Methods . . .

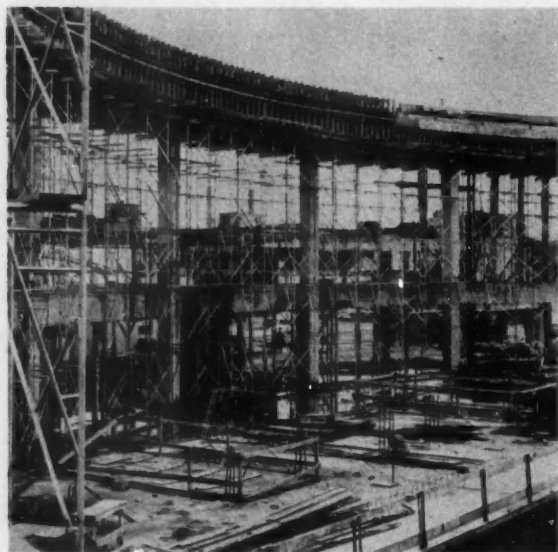
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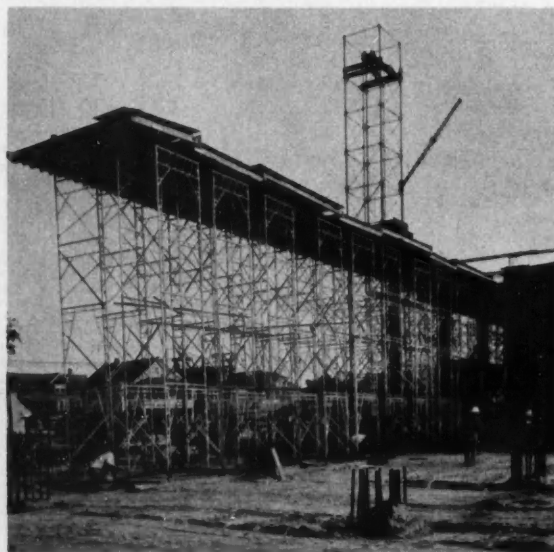
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SUPPORTS 3165 LBS. PER FOOT—Here, "Trouble Saver" Sectional Steel Shoring components are shown arranged to support a 242" diameter concrete beam, 47' above ground. Beam is 5'8" wide, with irregular depth to 4'6". While the height to which this shoring is erected is interesting, the major importance is the fact that it is assembled to carry a load of 3165 lbs. per lineal foot of beam. Utica (NY) Memorial Auditorium. Sovereign Construction Co., Ltd., general contractor.



SLIDING SYSTEM FOR MINIMUM EQUIPMENT—To gain the substantial cost advantages of minimum equipment, Frank Briscoe Co., Inc., here uses sectionalized set-ups of "Trouble Saver" Shoring which can be slid from pour to pour for the 8" floor slab of the new 250' by 275' Western Electric Co. Bldg. Boston. 22' x 125' shoring sections, with forms and dropheads in place, are slid forward between columns by cables attached to wood sills. Bulldozer used for power. Photo shows one narrower section just after movement.

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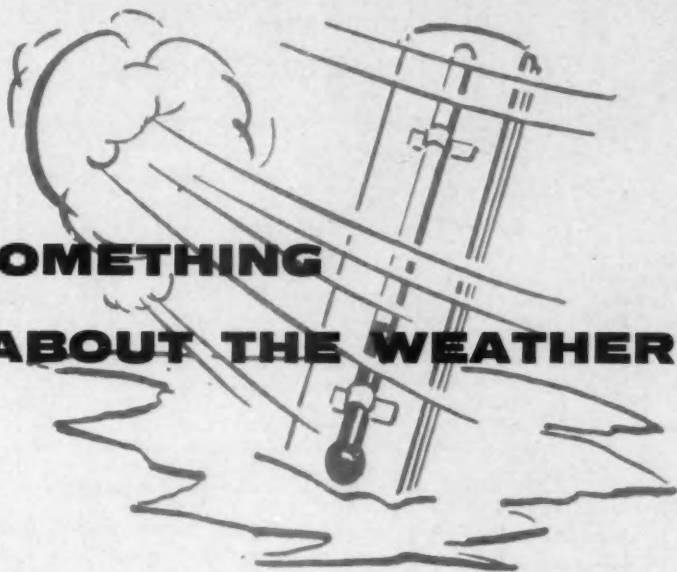
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YOU CAN DO SOMETHING ABOUT THE WEATHER



OF ALL THE PROBLEMS which plague the concrete contractor, none is so persistent, nor so disastrous at times as the weather. And strangely enough, there is no problem involved in his operations of which the contractor has less specific knowledge than the weather.

This probably is the result of a long-standing feeling that weather is an act of God, and since nothing can be done about it anyway, why worry over it? Yet, this isn't altogether true. Something *can* be done about it. But this something must be predicated on at least a passing acquaintanceship with the complexities of weather. There can be considerable profit to the contractor in acquiring some basic information about weather and how it works.

Weather has played an important role in the lives of mankind since time began. Even Christ prophesied the weather when he said: "When it is evening, ye say, It will be fair weather; for the sky is red. And in the morning, it will be foul weather today; for the sky is red and lowering."

If you've been depending on the groundhog, rheumatic joints and the Farmer's Almanac for your weather data, you'll be happy to know that a little knowledge of the things that make weather can stand you to good advantage.

There are five elements of weather with which you should be passingly familiar in order to make an educated guess on what tomorrow will bring. They are: clouds; wind; barometric pressure; temperature; and fronts. Let's consider and analyze each one of them

individually for a moment.

Interpreting Cloud Formations

Clouds are the most easily discernible signposts of changing weather. Here, in very general terms, are what they are likely to mean. Altostratus and stratocumulus clouds moving in usually precede a cold front and bring rain or snow with them. They move rather swiftly. In the eastern part of the country, there is usually clear weather behind the cold front; further west, the clouds are likely to hang around for a day or two after the front has passed.

Cirrus and cirrostratus clouds, followed by a thick layer of altostratus, usually presage the coming of a warm front. This is likely to mean a period of steady precipitation followed by warmer weather. Cirrus or cirrostratus clouds alone have little significance other than to indicate a continuation of present weather. When clouds appear from the south, they are likely to bring precipitation; from the north, clear weather will probably follow.

Interpreting Wind Shifts

Changes in wind velocity don't necessarily mean changes in weather. There is a daily rise and fall in wind speed that is perfectly normal—high in mid-afternoon, low at daybreak. But a sudden and precipitate shift in wind speed is the indicator of an approaching shift in the weather; when a steady, unexpected breeze begins to blow, watch for changeable weather. Likewise, a rapid change in wind direction

indicates an upcoming blow. Generally, winds from the east and south bring foul weather, and from the north and west, fair weather. When the winds are shifting from east to south to west, there is likely to be more pronounced and more tempestuous weather changes than when the direction of shift is through the north.

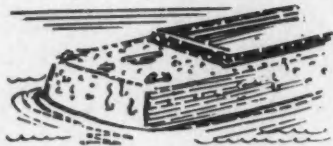
Interpreting Pressure Changes

Although the barometer, which measures air pressure, is more dependable in winter than in summer, it is always an important adjunct to the weather prognosticator. The most important message from the barometer is the trend of its readings and not what it happens to be pointing to at the moment. Like wind velocity, barometric pressure fluctuates regularly—with the highest pressure in mid-morning and the lowest in late afternoon. Discounting this normal fluctuation, if there is a steadily rising trend showing on your barometer, this usually indicates clearing skies; conversely, falling pressure means a spell of approaching bad weather. (Caution: barometer readings seldom indicate summer thunderstorms.)

Interpreting Temperature Changes

Several useful generalizations can also be drawn from changes in temperature. Usually, temperatures will rise slightly just before a storm, with this tendency more pronounced in the winter. Temperature is also greatly dependent on wind direction and speed and the expected cloud cover. Thus

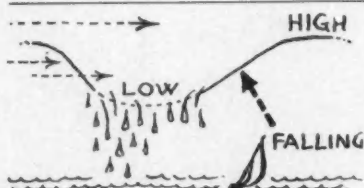
Weather Sayings of the old Sailors



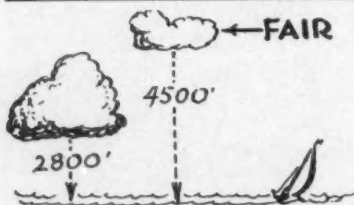
Dew indicates a good day ahead.
A dry morning is sign of showers.



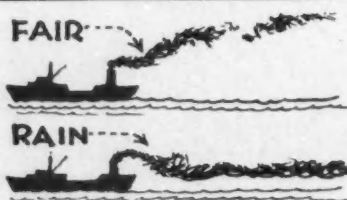
Large halo around the moon indicates cirrus cloud form and warm front rain.



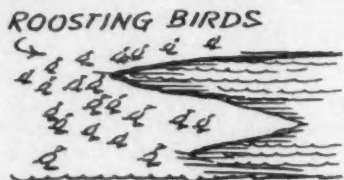
Falling barometer indicates nearing "low" area, with winds and rain.



Higher the clouds, finer the weather.
Lowering ceilings foretell rain.



Smoke that curls downward and lingers means a nearing storm.



Thinning air is harder to fly in.
Birds "sit it out" before a storm.



Sky full of webby cirrus foretells disturbance and rain on its way.

Sailors' sayings concerning the weather are based on centuries of close observation by men whose lives often depend on the shrewdness with which they can outguess nature. Contractors who don't wish to go in for scientific forecasting might do well to acquire some rule of thumb bases for prediction.

northerly winds will usually reduce the temperature, but if they are accompanied by clouds which shut off sunlight, the drop will be greater than might normally be expected. Temperatures will also vary considerably more from night to day during the winter than in the summer.

The Fronts

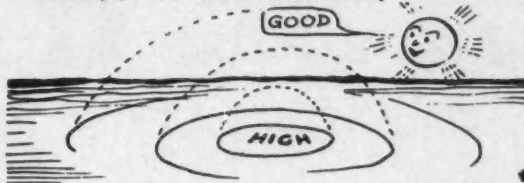
All of these diverse elements are involved in the formation and movement of fronts, which dictate the state of our immediate weather. A front is simply an air mass with very distinctive characteristics all its own. Fronts wander about the atmosphere, following a rather general eastward course, bumping into each other occasionally, and always leaving weather in their wake. A frontal surface in the atmosphere separates two dissimilar masses of air. Along these frontal lines, air masses pull and tug at each other—while down below we put up with the resulting rain, sleet, snow and ice. Warm air, meeting a mass of cold air, will naturally rise above it; the abruptness of this rise determines the cloudiness and precipitation which accompanies the movement of a front. Fronts may be from 5 to 50 miles in depth. You can usually determine the passing of a front by a change in wind direction. Generally, the more sudden this wind shift and the greater the change in direction, the more rapid is the change in weather that accompanies the front. Rapid changes in wind also indicate an especially fast moving front and a shorter period of bad weather. If the wind shift is slow and laborious, you are likely to have precipitation and cloudy weather for a longer time.

Interpreting Weather Maps

Now, with this handful of facts in hand concerning the elements which make up weather, where can you look for assistance in predicting up-coming weather?

Probably the most useful tool is the weather map, which appears daily in your newspaper. You should understand that when you consult a weather map, you're looking at *yesterday's* weather. The map was probably made up sometime the previous afternoon. Thus the main function of the weather map is to offer you a picture of weather trends. By comparing the indications on the map with today's actual weather, you can predict with more certainty what is likely to turn up tomorrow. The weather map is not a static thing; it is a still picture snapped in a fast-

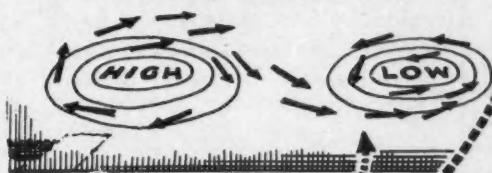
HIGH (H) is a mountain of air density



LOW (L) is a sinkhole of air density



Note how winds blow clockwise **OUT** of the high and **INTO** the low counter-clockwise



OCCCLUDED FRONT (---) is where a cold mass overtakes the warm ... winds, hard rain

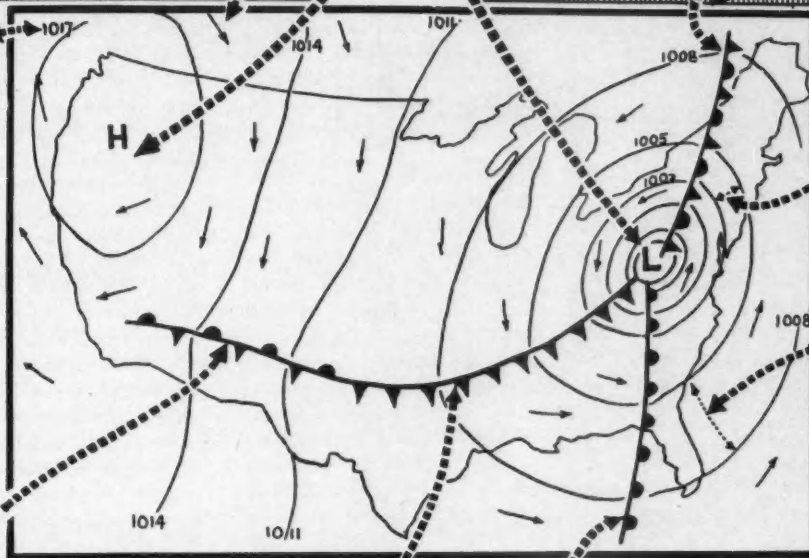


Numbers are just measurements to indicate contours of the air density.

They are often in Millibars

1011

29.86 or inches of Mercury



Close Isobars, High wind

Isobars Far Apart Low wind

COLD FRONT is a front of cooler air . . . (CUMULUS clouds, showers, gusts)

WARM FRONT is front of warmer air . . . (STRATUS clouds, dull rain)

STATIONARY FRONT (---) does not advance



Long rain, low wind, dull cloud ceiling.



Cold air swings down from North, warm air swings up from South, but all weather tends to move **EASTWARD** about 600 miles daily



Dotted lines in the drawing above lead from the various features of a typical weather map to a thumbnail explanation of each feature. The diagram includes one of each kind of front, and by

studying it and the accompanying sketches, and relating the information to the current weather map in the daily paper, the reader can master some of the essentials of making forecasts.

moving sequence of events. The weather at the moment is likely to be considerably different from that shown on the weather map in today's paper.

The following generalizations can be made from your weather map with reasonable hope of accuracy:

▶ A high pressure area usually means clear weather, a low pressure area, precipitation;

▶ Winds blow clockwise *out* of a high and counter-clockwise *into* a low;

▶ A cold front is likely to pass with gusty winds, heavy cumulus clouds and scattered precipitation, with reasonably clear weather behind it;

▶ A warm front will likely bring steady precipitation and be followed by cloudy, lowering skies;

▶ An occluded front (where a cold mass overtakes a warm front and the two collide) results in high winds, heavy precipitation, and generally bad weather;

▶ When the circular lines (isobars) around a low or high pressure area are close together, this indicates high winds; far apart means low wind velocity;

▶ In general, cold air comes down from the north and warm air up from the south, but the general movement of all weather is eastward at a rate of about 600 miles daily.

Five-Day Forecasts

In addition to weather maps, the Weather Bureau puts out five-day forecasts which are also usually published in your newspaper. Since these forecasts are issued two days ahead of the forecast period, they actually attempt to predict the weather a week ahead. This involves a rather complex projection of weather phenomena and can't be completely relied on; however, five-day forecasts are becoming increasingly accurate as the science of weather is better understood and plotted. Augmenting the five-day forecast with the daily weather map and a basic knowledge of what constitutes weather should enable you to make a reasonably accurate prediction of what to expect in the next few days.

Long-Range Forecasts

Longer weather trends are available, but not very dependable. The Weather Bureau makes 30-day forecasts which it still considers highly experimental. Almanacs and climatologists use statistical data and recurring weather patterns over the years to project long-range weather trends. Once in a while

these are spectacularly successful—a circumstance which sometimes blinds the layman to the normal unreliability of such long-range prognosticating.

Weather Patterns

There is also a wide variety of data published by the Weather Bureau which is available for public consumption. Most of this material is statistical data showing weather patterns over many years in various parts of the country. Some of this information could be quite useful to a contractor; although it wouldn't give you precise data on tomorrow's weather, it would indicate rather clearly weather trends in your section of the country which might help give you a sound basis for planning construction work during various seasons of the year. Any of these publications can be obtained by writing the Weather Bureau, U.S. Department of Commerce, Washington.

The Weather Bureau

The Weather Bureau is one of Big Government's biggest bargains. For about \$45 million of the taxpayers' money annually, the Weather Bureau operates almost 600 weather stations, over 10,000 climatological substations and 2,200 ship and airway reporting stations. Upper air observations are taken from more than 300 balloons and other devices. All this information is daily noted, tabulated, interpreted and given out to the public. It is to the advantage of the contractor—probably as much as any other single group in the nation—to make full use of this information so painstakingly assembled.

Private Forecasting

A recent addition to the weather picture may turn out to be one of the most beneficial elements of all. This is the private meteorologist, or weather engineer. After World War II, there was a growing realization on the part of a number of industries—including the construction industry—of the important role played by weather in its operations. Advance knowledge of the weather might save millions of dollars and even a few lives. Private meteorologists came into being to satisfy this need; these weather specialists serve as a liaison between the mass of data collected by the Weather Bureau and the specific problems of particular industries. Indications so far are that these new specialists are performing an effective and

tremendously worthwhile service.

Here's how it works. A group of contractors in a locality, for example, get together and hire their own weather expert. He will also have other clients in other types of industry. He will gather all kinds of general weather information and distil from it the specific information required by his clients, after making a thorough study of the weather problems of special concern to them. Suppose a large construction job is started during a late fall month; the contractors involved are concerned about the weather, particularly those charged with placing concrete. The weather expert, consulting his charts, his trends, his histories, and his probabilities is able to advise the concrete contractor on the number of hard freezes he might expect and approximately when to expect them for the next month. He also predicts the amount of expected rain or snow.

These long-range predictions, even though not completely accurate, enable the contractor to organize his construction planning.

The long range predictions are then supplemented with operational or short-range forecasts in which the weather engineer indicates, from five to seven days ahead, the general temperatures and precipitation to be expected. These are in turn augmented by daily detailed forecasts, subject to hourly change with any perceptible variation in the weather pattern. Working closely with the weather engineer and correlating all this information with daily, weekly and monthly construction schedules, the contractor is able not only to live with the weather but to cut down considerably on time and money losses due to bad weather.

Even though concrete is peculiarly susceptible to the elements during construction periods, there are now many devices to protect concrete construction from bad weather *if they are put into effect in time*. This is where the services of a weather engineer, or even some basic weather knowledge on the part of the contractor, can be of tremendous help.

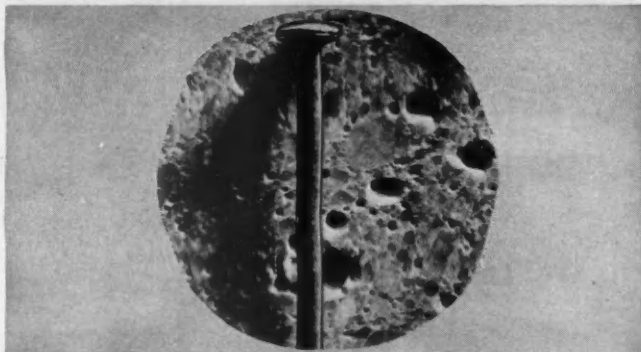
It's impossible ever to predict the weather with absolute certainty. But the element of doubt can be small, indeed, if you know what you're looking for when you peer skyward of an evening wondering whether or not the heavens will cooperate for the big pour you have scheduled tomorrow and the day following. Then, your sky wisdom can make you a richer man. **END**

3 points to watch for better winter concreting

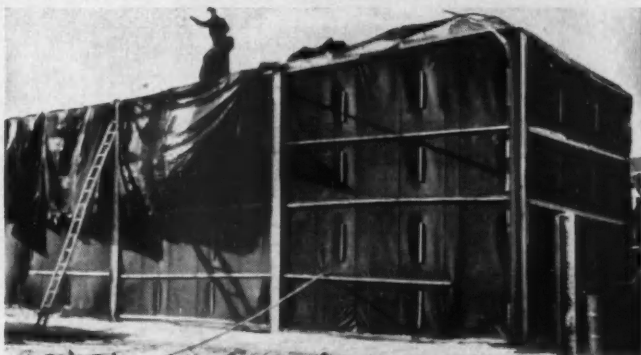
1. Plan ahead. Concrete will be delivered at a temperature between 50° and 70°F. Be ready to place at once. Have forms and reinforcing steel free from ice and frost—live steam works best. And, of course, never place concrete on frozen ground. It will settle when it thaws.



2. Specify air-entrained concrete for all jobs—structures and pavements. Resistance to freezing and thawing is greatly increased—freezing water in the concrete has room to expand harmlessly into the air cells. Magnified photo shows size of air cells compared with ordinary straight pin.



3. Provide suitable curing temperatures. Use protective coverings as needed, either with or without moist heat, to keep concrete at 70° or above for 3 days, or 50° or above for 5 days. Protect from freezing for at least 4 days. Rate of cooling concrete shouldn't exceed 1 or 2 degrees per hour.



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PORTLAND CEMENT ASSOCIATION

Dept. A2-98, 33 West Grand Avenue, Chicago 10, Illinois

A national organization to improve and extend the uses of concrete

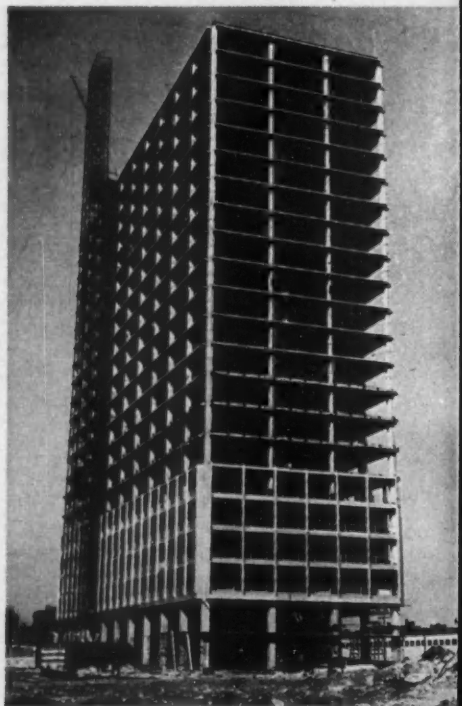
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as in Detroit Today . . .



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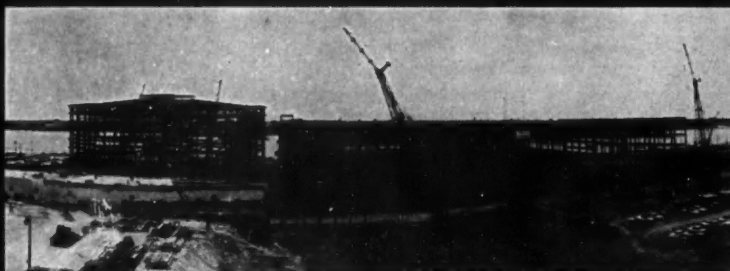
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The designers and builders of these fine structures employed POZZOLITH* to obtain concrete of superior quality most economically.

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Workmen on the project discussed in this article are here seen making a first pass over a 4-inch slump concrete with a 24-foot 8-inch vibrating screed. The contractor on this project believes that a saving of 16 man-hours per slab was accomplished by employing the vibrating screed. The screed beam was notched to clear the termite shields which are plainly visible at the edges of the slab.

VIBRATING SCREED SAVES 16 MAN-HOURS PER SLAB

THE PRICE OF SURVIVAL in the competitive field of construction is a constant effort to investigate every possible means of achieving better economy on the job. Contractors who have discovered this principle, and who operate in accordance with it, will be interested in the experience of a Connecticut firm which ran into serious difficulties with the economics of concrete slab construction for a housing project.

Initially the slabs were placed by dividing the areas into three sections, and employing screed supports which required carpenters an average of one to one and a half hours per unit to install. The sections were subsequently poured separately and struck off by the time-honored method of sawing back and forth over the concrete with two-by-four screeds.

Because this method proved unsatisfactory both from the standpoint of economics and the quality of the end result, the contractor investigated the

possibility of using a vibrating screed. An adjustable commercially-manufactured vibrating screed was selected which was capable of being adapted readily to slab lengths of 36 feet 8 inches, 40 feet and 44 feet and 8 inches.

Since the screed rollers for this unit could ride on the concrete sidewalls, the need for screed supports was eliminated. The screed beam was notched at the ends in order to clear the metal termite guard around the outside of the slab.

The 4-inch slump concrete was placed to a depth of 4 inches and raked ahead of the screed to the approximate height of the screed, which was then pulled across the slab, vibrating and striking it off at the same time. Two passes were made for each slab.

In a fairly typical slab placed in connection with this project, 12 cubic yards of concrete was prepared, spread and screeded all in one hour. This

particular slab measured 24 feet 8 inches by 36 feet 8 inches. The head of the contracting firm estimated a total saving of 16 man hours per slab. This saving reflects not only a reduction in the number of men required in the crew, but an additional saving in the total time required to place each slab.

The contractor on this project also reports that there was an additional time saving which resulted from the fact that the slab could be accurately held to grade when the vibrating screed was used. In consequence of this, there was a substantial saving in carpenter labor for setting up room partitions.

END

Readers who would like to have additional information on the subject discussed in the foregoing article may request it by filling out one of the reader service cards in this issue.

FILE: Vibration



Concrete demonstrates its superiority over other building materials in a new and dramatic way as this . . .

CONCRETE GAS STATION PROMOTES TRADE

DIRT EXCAVATED ON THE SITE for the burial of gasoline tanks was used to create a form atop which a concrete dome was poured as part of the design for a most unusual but functional gasoline service station in Alexandria, Louisiana.

Not only was the use of earth excavations an economical process for the fashioning of the concrete dome in that it saved considerable and expensive carpenter work, but further savings resulted when it came time to clear the dome. This was done quickly and inexpensively, compared to conventional form removal, by simply sending a small tractor equipped with a blade to bulldoze out the mounds of dirt from inside.

The net result was a dome that, along with three concrete canopies, makes this station outstandingly attractive and a sure traffic-stopper.

The station is built on a lot 150 feet long on two sides, 155 feet on the third, and 109 feet on the fourth side. The air-conditioned lounge-sales area is roofed by a thin-shell concrete dome, 2½ inches thick, in the form of a spherical triangle. To add further to its architectural beauty, a reflecting pool circumscribes this lounge-sales section.

Canopies over the pump islands and the service racks are pairs of concrete

barrel arches supported by T-shaped concrete frames. The concrete for the vaults was placed on plywood forms and for the dome on an earthwork form.

The two service bays are covered with the concrete canopies and have concrete block walls extending to the height of the wings. Pump islands and service bays are so located on a circular drive surrounding the sales, display and lounge structure that an outside peripheral drive permits motorists to make an unobstructed entrance and exit circle around the station.

The triangular salesroom section of the station, in the form of an equal-sided triangle, is roofed by the concrete dome which is in the form of the spherical triangle previously mentioned. The salesroom walls are steel framed from floor to dome. The concrete dome touches the ground at three points, resting on three 4-foot-wide footings.

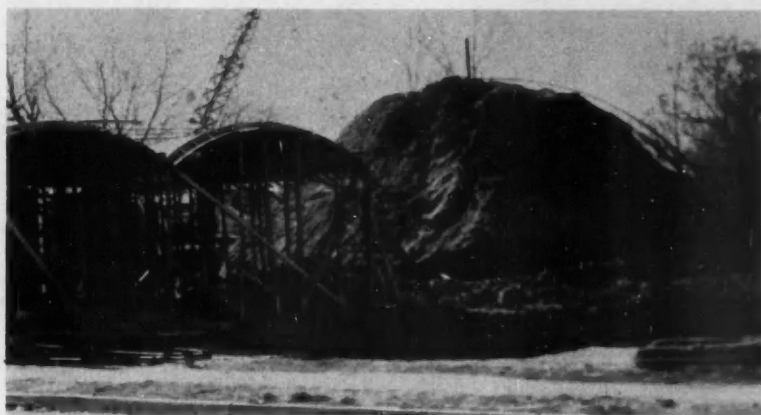
Three wings house four restrooms, offices, and storage space. These connect the sales area with the concrete-canopied pump islands and service racks. The wings span a goldfish pool which circumscribes the sales area, with the pool areas surrounded by rock gardens. The restrooms and office wings have flat roofs which run from under the nearest concrete canopy to

the wall of the salesroom, with the walls of the wings made of face brick.

On opening day, the station sold gasoline to nearly 6,000 cars, many of whose owners were attracted by the unusual concrete construction. The station is said to have sold 25,000 gallons during its first month of operation, excluding the opening day volume, and remains a continuing attraction to beguile new trade.

Unquestionably, a new day is dawning for concrete as a building material when its beauty and versatility can be used to help promote the occupant's business. Moreover, the dramatic design success and economies of workmanship illustrated by this gas station job amply demonstrate that the novel approach to concrete construction is by no means the monopoly of a chosen few. In bidding for any job, it may be well worth your time to consider the novel approach—especially if it means you can capture for a potential customer the latent sales appeal of concrete as a structural material. Step by step construction photos are shown on the facing page.

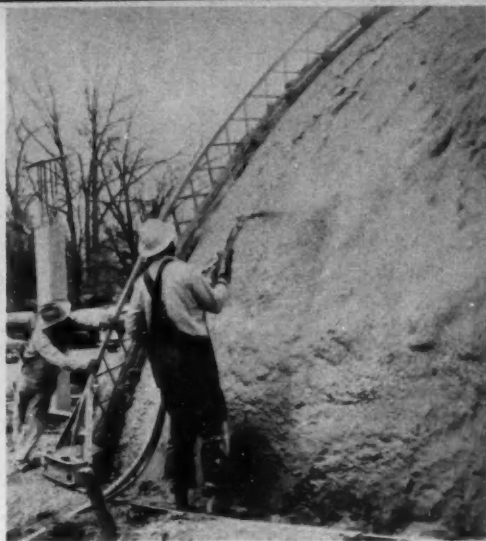
Architects on this unusually appealing structure were Glanker and Broadwell of Alexandria, Louisiana. Concrete contractors were Gravier and Harper, with Otto Gruenwald of New York acting as structural consultant. END



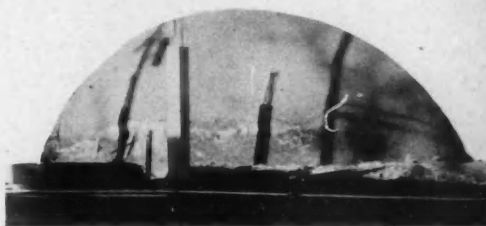
1

Shown above (1) are the plywood forms for the concrete canopies to be erected over the station's pump islands. To the right of these is the dirt that was excavated to make room for burial of the station's gasoline storage tanks. The dirt was piled high to make the form for the domes.

The photo (2) at the above right shows workmen making the form for the concrete dome. Mortar is first sprayed over the mound of excavated dirt and then given a smooth finish with the curved screed shown here. The use of earth excavations for the base of this form proved most economical.



2



3

Above (3), you see the completed form for the concrete dome. In front of the dome is one of the supporting pillars for the other structures. Pillars are also concrete.



4

At the left (4), freshly poured concrete covers the dome form in the shape of a spherical triangle. When the 2½-inch-thick shell was set, a small tractor equipped with a blade cleared out the mound of dirt from underneath.

5

At the right (5) you see the earth being removed from underneath the finished dome structure. No expensive labor was required to tear down the forms, as is the case with conventional form construction.



To ease supervision problems . . .

Contractor Uses Radio During Peak Seasons

By Richard Carter, Jr.

MOST CONTRACTORS TODAY are familiar with the use of two-way radio systems by producers of ready-mixed concrete to facilitate communication between batching plants and the truck-mixer fleets which now account for so large a part of all job-placed concrete. Not so familiar, perhaps, is the fact that contractors themselves are also adapting this excellent communications method to their own needs.

Richard Carter & Son, Inc., of Baltimore, for example, is a concrete forming and pouring outfit in the residential construction field. With the bulk of business occurring in two peak seasons, keeping the customers happy could become one big headache. Under normal conditions every contractor customer needs his work done immediately so that he can either get under roof before cold weather or start on construction as soon as it gets warm.

During peak seasons the company

scatters equipment and men on 30 different jobs a day in the Baltimore area. Hiring the 300 laborers needed to handle these jobs is no problem. The stickler enters the picture in supervision of the jobs. The company has three top-notch supervisors and a general manager to make sure the jobs are being done right, to solve any special problems, and to make important decisions. They also keep the men working, insure the happiness of the contractor customers and struggle constantly with the problem of operating in about four different places at once.

In an effort to achieve this impossibility, the four field supervisory personnel travel 75 to 100 miles a day from job to job, trying to catch mistakes before they happen. This technique, up to last summer, was far from satisfactory. With telephones few and far between on new housing projects, locating a "super" to route him to an

emergency could be an hours-long problem. The solution proved to be a two-way radio system that keeps the field men in constant touch with the office.

The system consists of six mobile units and the base station. Four of the mobile units are in supervisor's vehicles and the two extra mobile radio-phones are in cars equipped for company executives.

The base station is controlled from three remote consoles in the offices. One is on the author's desk, another at the desk of the girl who answers the telephone, and the third in the blueprint rooms used by the supervisors. The network, specially designed to overcome interference from Baltimore television stations, operates on two FCC assigned frequencies in the Citizen's Band.

The system works fine, and it is doing an excellent job. With mobile



In the photograph at the left, General Manager Bob Matherly of Richard Carter & Son, Baltimore, and one of the company's supervisors check out job blueprint before answering tough questions posed by a third supervisor at the job site pictured below. With radio in key vehicles and remote consoles in three rooms of the company's headquarters, instant communication is possible among all top personnel of this forming and pouring outfit.



Photos courtesy Motorola, Inc.

radio in the supervisors' vehicles, about 30 per cent more of their time is spent where it is needed. The big effect of the radio communications system is that it puts the men in strategic points. This greatly improves service to customers. Here are a few examples of how it helps:

A contractor about to make a decision on where to send one of his crews calls in asking how soon the pouring of certain footings will be completed. Before radio, it would be necessary to wait for a "super" to call in from a point on his rounds, find out the answer and relay it back to the customer. If the supervisor hadn't visited that job yet, he'd have to make the trip, then find a phone and give the answer. Now, while the customer still is on the phone, it is a simple matter to radio the "supers" and find out the progress of the job. If they hadn't visited the site yet, one of them can be sent right over. Fast answers like this make for good customer relations.

If a work crew runs into a snag, one of the men can head for the nearest phone and call the office. With radio, the girl in the office will contact the "super" nearest the job and send him over. Or in some cases the information can be relayed from the "super" to the office and back over the phone to the crew with the problem.

Probably the greatest use of the radio is the mobile-to-mobile communications between the supervisors themselves. Through constant contact they are able to work out the easiest and best means of visiting the jobs during the day and handling any special calls. With radio in the cars of the two principal executives of the company, they too can participate in the conversations and are available for any problem whatsoever.

Doing the impossible, that is being in more than one place at once, would be the ideal way for key men to handle the all-important supervision job in the contracting business. Next best is getting to trouble spots as soon as possible, and this is entirely practical today with a two-way radio system. **END**

Readers who would like to have additional information on the subject discussed in the foregoing article may request it by filling out one of the reader service cards in this issue.



The Ideal "Double-Duty" Roof Fill

Not only does Permalite concrete give you lower weight than most other "lightweight" aggregates, but it usually eliminates the need for additional insulation. And Permalite concrete gives you other advantages . . . handles and places like ordinary concrete—is easily sloped to drains—can be either job-mixed or transit-mixed. Further bonus . . . you cut labor costs when pouring over structural concrete decks because the structural deck need not be trowel-finished—just rough-screeded.

LIGHT IN WEIGHT A 1:6 mix of portland cement and Permalite expanded perlite aggregate has a dry density of only 27 lb./ft³—a 2" thickness weighs only 4½ pounds.

NEEDS LESS WATER Concrete made with Permalite dries out faster than concrete made with any other type of aggregate in the same weight class, because Permalite requires less water.

STRONGER than Other Insulations A 1:6 mix has compressive strength of 180 psi . . . nearly 13 tons/ft². For greater strength, a 1:4 mix gives 440 psi . . . more than 31 tons/ft².

For the complete story on Permalite Concrete for roof decks and floor fills, write

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Perlite Department, Great Lakes Carbon Corp., 612 S. Flower St., Los Angeles 17, Calif.

Permalite aggregate is produced by licensed franchisees from perlite ore mined by Great Lakes Carbon Corporation.

Circle #207 on reader card

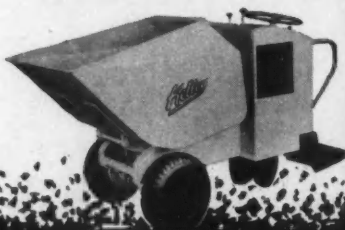
THE '59 LINE OF *Kelley*

CONTRACTORS' EQUIPMENT



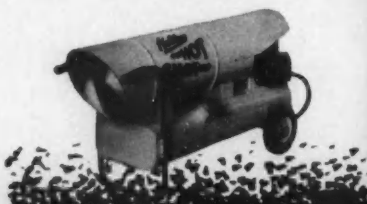
POWER TAMPERS

Self-propelled... delivering 2400 impacts a minute. Two models: 18" wide shoe, and 36" wide shoe. For packing down earth backfill to maximum density next to foundations, on road-widening jobs, etc. Also for finishing blacktop... with heater shoe attachment available.



POWER BUGGIES

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Six models to choose from... 2 de-luxe Hydra-Trowels, 34" and 44" sizes, with fingertip blade control... and 4 super models with manually-adjusted blade pitch: 24" Kelley Bantam, 29" Kelley Boy, the popular 34" Kelley Chief and the big 44" Kelley Commander... a size for every job.



COMPACTORS

The new Kelley Compactor with "Compaction Control"... easier operating, faster, more powerful. For compaction-floating all types of concrete floors, for keying in surface hardeners, and for bonding dry-tamp floor topping to a concrete slab. Grinding attachments available.

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Circle #208 on reader card

letters

more on sodium silicate

Sir:

It was rather gratifying to the writer to read the admission by the Executive Vice President of the Walter Maguire Company (November 1958 issue, page 22), that the obsolescence of sodium silicate as a curing compound "is very possibly true," and even more gratifying to note the concession that sodium silicate "would not provide especially effective curing."

However, Mr. Hennegar's statement "that there is a relatively new special formulation of a sodium silicate-based curing compound incorporating a non-acid detergent penetrant," cannot go altogether unchallenged.

We have known for a long time that the formulation in question contained a small amount of a detergent to reduce the surface tension of the sodium silicate and thereby wet the concrete surface better and penetrate beneath the surface. Of course, the wetting agent would have to be "non-acid" i.e., alkaline. If it were acid, it would be neutralized and rendered inactive by sodium silicate.

However, the addition of a wetting agent to a salt solution, alkaline or acid, does not alter the chemical nature of the solution and cannot chemically influence its function.

The point is that the addition of a wetting agent is in itself old. Many applications of the principle are on record ever since surfactants have been introduced into industry. The writer himself has taken out a patent in 1940 based on the use of wetting agents in metallic fluosilicate solutions, precisely to accomplish the same thing with a fluosilicate hardener as soap or other alkaline detergent accomplishes in a sodium silicate system.

In short, the use of a "non-acid detergent penetrant" is indeed an improvement over straight sodium silicate. But, to claim novelty for the idea is another matter.

L. LIBERTHSON
Technical Director
L. Sonneborn Sons, Inc.
New York, N. Y.

specification isn't specific

Sir:

In reading through your interesting November 1958 issue I noted on page 20 that you state that ASTM specifications indicate quite clearly that in a slump test "measurement must be taken to the highest point on the concrete, even when a single piece of aggregate projects well above the rest of the material."

In referring to the ASTM specification which prescribes the standard method for making a slump test (C143-52), I have been unable to find any statement which denotes the exact level at which the measurement should be made. The ASTM specification reads in regard to this point, "The slump shall then be measured immediately by determining the difference between the height of the mold and the height at the vertical axis of the specimen."

As you can see, there is no clear-cut statement in the specification similar to the one made in the answer in the Questions and Answers column. Many laboratories measure from a point approximately midway between the lowest and highest points on the top of the plastic concrete to the rod.

ALFRED L. PARME
Manager

Structural and Railways Bureau
Portland Cement Association
Chicago, Illinois



floor blisters

Sir:

We recently completed an Elementary School in Platteville, Colorado. In connection with this project we have a concrete floor problem and we are writing with the hope that you might be able to help us.

The concrete floor was poured during November 1957 and appeared to be in excellent condition. However, asphalt tile was placed over the floor in June of this year, and approximately three weeks later small blisters appeared over the entire area covered by the tile. The lapse of time after the concrete slab was placed until the blisters appeared was, therefore, about seven months and not until after the asphalt tile was in place. These protrusions were about $\frac{3}{4}$ to 1 inch in diameter and a maximum of $\frac{1}{8}$ inch high and averaged about one per square foot of floor area. The blisters

are prevalent over the entire area covered by tile with certain areas having a greater concentration than others. In some instances there were three blisters per tile. We removed approximately a dozen tile to examine the blisters. We found there was a heaving in the concrete and under these blisters the concrete could be dug out with a pen knife to a depth of $1\frac{1}{2}$ to 2 inches and about the size of a pencil. The concrete around the hole and under was in good shape. It is apparent the blisters are caused by some type of pressure, chemical or otherwise, due to the fact the concrete has actually expanded.

The aggregate for this concrete came from an accredited, tested plant and is approved for use by the Colorado State Highway Department and Federal Bureau of Reclamation for their projects. The Commercial Testing Laboratories of Denver have made numerous tests of the aggregate over a period of years and the results have always been satisfactory. A complete analysis and design mix was made just prior to the construction of this school. The cement used was Type I manufactured by Ideal Cement in their Fort Collins plant. Numerous compression tests were made during floor construction and all were in excess of 3000 psi with 2500 psi required by the specifications.

We have consulted with the architect, several engineers, the Portland Cement Association, builders in the area and any one else we thought

might help us with this problem but none have been able to determine the cause. However, it is the opinion of one of the leading floor covering contractors of Denver that the condition is being created by alkali in the sub-soil. The identical size blisters have appeared in tile laid by them in two areas of Denver where alkali is present in the soil.

It is true that the school is located in an area spotted with alkali. However there were no soil tests made for alkali for this project. Also the water used for the job-batched concrete could have been alkaline.

I wish to point out again that none of these blisters were in the concrete until the tile was in place about three weeks. And in areas of the building that did not receive an asphalt tile covering, there are no blisters to date, although these areas were poured at the same time.

We will appreciate any explanations or suggestions you might be able to offer. If any of your readers have been confronted with this or any similar problem, we would like to gain the benefit of their experience.

J. V. BONNY
Maber Construction Co.
Denver, Colorado

Diagnosis from a distance is always risky business, but if any readers of Concrete Construction have had experience with similar problems, we'll be glad to relay their comments to Mr. Bonny.

EDITOR

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26-23



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book reviews

Effectiveness of Concrete Admixtures in Controlling Transmission of Moisture Through Slabs-on-Ground. Edited by William S. Brown. Published by Building Research Institute, 2101 Constitution Avenue, Washington 25, D. C. 33 pp. Illus. \$1.50.

The purpose of this study was to provide the Federal Housing Administration with authoritative answers to certain technical questions as to whether concrete admixtures are effective as a protection against ground moisture and vapor penetrating slabs-on-ground. A further purpose was to develop a test method for determining acceptability for any given admixture. The report gives the answers arrived at by the Building Research Advisory Board to four questions formulated by FHA: (1) Under what conditions, if any, could the use of admixtures be considered acceptable as a protection against ground water and vapor penetration of the slab? (2) What test procedures and criteria are recommended for determining the acceptability of any admixture? (3) What would be the effect on heat loss through a slab-on-ground with admixtures? (4) What controls should be exercised to assure proper application of admixtures?

Supporting information and test procedures are given, as well as sections on how the study was conducted and how it is intended to be used.

Prestressed Concrete Design Handbook, Volume 9. Published by Leap Concrete, Inc., P. O. Box 1053, Lakeland, Florida. \$2.00.

This handbook, Volume 9 of a series, cover the 5-foot wide by 18-inch deep double tee roof members. Data is included on safe superimposed loads in the span range of 20 feet through 61 feet using 7/16-inch diameter strand with both parallel and depressed designs. A data sheet for each strand pattern gives spans, loadings, prestressing force, principal concrete fiber stresses, camber, deflection, release strength of concrete and 28-day concrete strength. Complete technical information on 116 different combinations which will enable the architect or engineer to specify quickly exactly which double

tee to use under any given condition, a section on basic design of prestressed concrete, and a table of loadings for nine other prestressed structural members such as the channel and keystone joist, are also included.

Legal Aspects of Construction. By Walter C. Sadler. Published by McGraw-Hill Book Company, Inc., 327 West 41st Street, New York 36, N. Y. 400 pp. Illus. \$8.50.

Rights and liabilities involved in the complex relations of the construction industry are reviewed in this new book, written as an aid toward avoiding legal entanglements and costly litigation. The author traces the pattern of the business of contracting and examines the roles of the contractor, designer, owner, and financier. He discusses a number of actual cases illustrating the adjudicated rights and liabilities of the parties-in-interest and includes coverage of boundary, lateral support, and foundation rights and available remedies at law and in equity.

The book is unique in its recognition of construction as a business involving the potential conflict of interests of contractors, subcontractors, sub-subcontractors, and trade unions, as well as factors of individual union contract provisions and federal, state, and local regulations and codes. A feature of the volume is its coverage of the law "at boundary" in logical sequence and in unusual detail. Drawings of special value to contractors, designers, and material suppliers are included.

Civil Engineering Handbook. Editor-in-Chief, Leonard C. Urquhart. By Porter, Urquhart, McCreary & O'Brien. Published by McGraw-Hill, 327 West 41st Street, New York 36, N. Y. 1174 pp. Illus. \$17.50.

This fourth edition of a well-known handbook presents a large body of essential theory, standards, practice, and data for solving specific problems in civil engineering. Ten large sections cover modern advances in city surveying and railway engineering standards, hydraulic models and bridge trusses, and the design of concrete mixes and dams.

The handbook was written by a

number of authorities and gives rules, principles, working methods, and engineering pointers. The experts cover mechanics of materials, stresses in framed structures, steel design, highway and airport engineering, water supply, sewage disposal, and other aspects of civil engineering.

History of Mathematics. By D. E. Smith. Published by Dover Publications, Inc., 920 Broadway, New York 10, New York. Two volumes. \$5.00.*

Did you know that if it had not been for the Great Fire of 1666 and the necessity of rebuilding St. Paul's, Christopher Wren would be remembered now as a mathematician rather than an architect? Or that Omar Khayyam whom we remember as the author of the Rubaiyat was an important 12th century mathematician, the first man to work out the binomial theorem?

These are typical examples of the interesting information to be found in this two volume set. The first volume is arranged chronologically by man and country. The second volume is arranged by subject, and discusses the evolution of the different divisions of mathematics.

*Either volume may be purchased individually for \$2.75.

How to Become a Professional Engineer. By John Constance. Published by McGraw-Hill Book Company, Inc., 327 West 41st Street, New York 36, New York. 288 pp. illus. \$5.50.

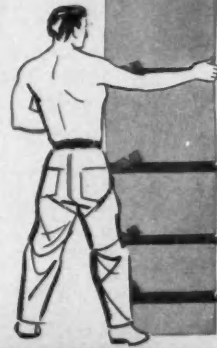
Movements are now under way in most states to require all engineers to become licensed. This book is a clear, comprehensive guide for both unlicensed engineers-in-practice and young graduates on how to obtain a professional engineer's license.

The author, who for fifteen years has been associated with refresher course work and the preparation of engineers for licensing, clarifies the seven basic requirements for licensure, summarizes the various state registration laws and gives examples of how examining boards evaluate the experience of candidates. The book also gives pointers on how to prepare an application, select the qualifying experience and write it up, prepare for written and oral examinations, what to look for in refresher courses and how to achieve multiple-state registration.

How Simplex 10-Foot Forms Saved 25% on a Shopping Center Project

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*Name on Request.



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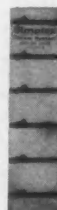
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Alarmed at the growing number of portable mixer thefts Essick Manufacturing Company has equipped all its concrete and plaster mixers with wheel slots. A chain may be passed through slots to allow locking both wheels together. In addition, removable draw bars allow user to remove the tongue and keep it in the truck, thereby reducing chance of theft through elimination of towing connection. **Essick Manufacturing Company, 1950 Santa Fe Avenue, Los Angeles 21, Calif.**

Water Reducing Agent

A ready-to-use liquid water reducing agent, Eucon WR, is claimed to increase the slump of plain concrete from 3 to 7 inches without changing the mix proportion, to give better placeability, more uniform aggregate coating and improved cohesiveness, to reduce bleeding, permeability, and dry-

ing shrinkage, and to make possible the lowest water content for a given workability. Durability is said to be greatly increased. The material may be used with other admixtures such as air entraining agents, calcium chloride and fly ash. Write **The Euclid Chemical Company, 1534 Hayden Avenue, Cleveland 12, Ohio.**

Dust Control

For use on road construction projects where severe dust conditions are common, Pentrate-treated water is said to be easier to apply, longer lasting and more effective than other methods. Pentrate is a liquid chemical which increases the wetness or penetrating power of water so that it is quickly and evenly absorbed into the dirt surface where it forms a moist protective layer which prevents the rise of the dry dust beneath it. Write **American LaFrance, Elmira, N. Y.**

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This pliable steel tubing for forming ducts in prestressed concrete and installing service ducts in concrete and concrete piles requires no special equipment or skill for installation. Exterior ribbing assures good bond with the concrete bed and the smooth interior bore offers free passage of cables, bars or grout. **Kopex Division, Gemmer Manufacturing Company, 6400 Mt. Elliott Avenue, Detroit, Mich.**

Vibratory Compactor

The Power-Pactor is designed for quick, convenient compaction and grading of stone, gravel and granular soils around foundations, footings, abutments and pipe lines, in sewer trenches, on bridge approaches and under concrete floor slabs. For asphalt work, a water feed attachment is offered. The handle is adjustable for height and can be telescoped for ease in transport. **Maginniss Power Tool Company, 154 Distl Avenue, Mansfield, Ohio.**

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A lightweight, inexpensive bench shear has roller bearings at the hinge points to ease the shearing operation. The frame is formed from 1/2-inch plate and the offset shape permits slitting a sheet within capacity. Round mild steel rods may be sheared up to 7/16-inch with only mild distortion caused by the shearing action. Write **Whitney Metal Tool Company, 110 Forbes Street, Rockford, Ill.**

equipment and tools

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A power trowel for floating and finishing concrete slabs has adjustable, 7 by 13-inch blades which can be altered for proper pitch while the machine is in motion simply by operating a handle control. Design features include low center of gravity for easy manipulation, uni-frame construction, blade-center suspension, automatic clutch, and non-rotating guard ring permitting use of the trowel within a half-inch of pipes, walls, and other obstacles. Write **Thor Power Tool Company, 175 North State Street, Aurora, Ill.**

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A finishing machine which is said to be adaptable to a wide range of highway and elevated bridge projects at increased production speeds is assembled of four main components clamped together with a new type clamp that makes it easy to assemble, dismantle and adjust to job application. Hydraulic lifts raise and lower screed from 24 inches below riding rails, with the wheels in the highest position, to 4 inches above the rails, with the wheels in the bottom position. Light in weight, it is available with rear screed and/or hydraulically operated burlap drag. Write **The Heltzel Steel Form and Iron Company, Warren, Ohio.**

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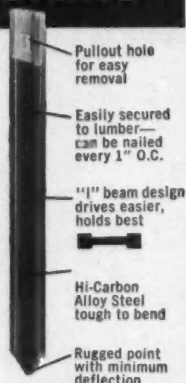
Pile Driver

This new Trac-Hammer for concrete breaking, pile driving and drilling is an adaptation of the Vulcan Portable Pile Driver for use on Gardner-Denver's Air-Trac drilling rig. It can work indoors, reach corners and perform in areas formerly inaccessible with mobile rigs, according to the manufacturers. **Gardner-Denver Company, Quincy, Ill., and Vulcan Iron Works, Chicago, Ill.**

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Operated by one man, this 220-pound, gasoline powered self-contained earth rammer features a positive carburetor, automatic built-in lubrication system, positive control for safety, and maximum compaction. It jumps to a height of 18 inches, 80 times per minute, exerting 311 foot pounds with each blow, on lifts up to 24 inches. **Complete Machinery and Equipment Company, Inc., 36-40 Eleventh Street, Long Island City 6, N. Y.**

Fork Lift

Up to 1000 pounds can be raised 7 1/2 feet in 15 seconds with the Kwik-Mix S-10 Moto-Bug. A flow regulator controls the drop. The telescoping mast tilts 10 degrees back and 2 degrees forward. Forks can be adjusted to accommodate various sizes of loads. The unit is easily changed to a platform or hopper carrier. **Kwik Mix Company, 235 West Grand Avenue, Port Washington, Wisc.**

Mechanical Hoist

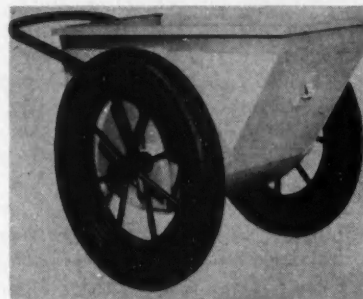
This sturdy, free-standing, low priced mechanical hoist has a load capacity of 1000 pounds and a lifting speed of 125 feet per minute. A basic height of 22 feet permits unloading to 18 feet. Additional sections extend the operating height to over 100 feet. A concrete bucket to be attached to the platform is available. **Tubular Structures Corporation of America, 2960 Marsh Street, Los Angeles 39, Calif.**

Installing Posts

Fully adjustable, vertically and horizontally, Ancor-Eez requires a minimum of tools and effort and no special skill for installing and anchoring posts to concrete either before or after pouring. They are said to stop termites at the metal base and eliminate damp rot. They meet F. H. A. requirements and are approved by city and county building inspectors. **Woodmack Products, Inc., 540 Commercial Street, San Jose 12, Calif.**

Narrow Concrete Buggy

This strong, lightweight buggy with a capacity of 6 cubic feet is constructed to go through a standard 30-inch doorframe and into previously inaccessible locations. All types of



Muller concrete buggies are available with either pencil bearings or cage type roller bearings which are said to reduce noise and make operation easier. **Muller Machinery Company, Inc., Metuchen, N. J.**

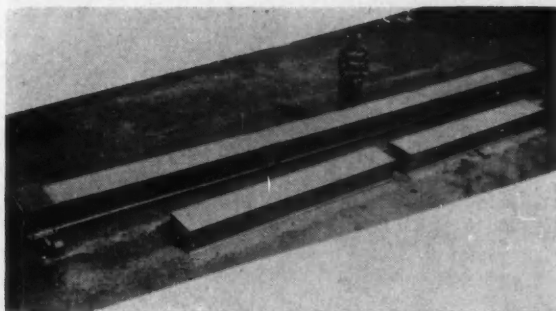
Anchoring Device

A steel clip for anchoring wood flooring to concrete floor decks is galvanized to resist corrosion. The tabs are set in the moist concrete. After the concrete has hardened, the two top tabs are bent up, sleepers are placed between them and nailed through holes in the tabs. The finished floor is then nailed to the sleepers. The clips are available in sizes to accommodate 2, 3, and 4-inch sleepers. Write **Bull Dog Floor Clip Company, 406 S. W. Ninth Street, Des Moines 9, Iowa.**

Patching Material

Contractors for a residence hall at the University of Illinois tried a new material for cement finishing, New Formula Ready Patch. They found that it feathered out easily to form a smooth surface for painting, and that it filled in all pin holes and form joints. They report a 50 percent reduction in man hours and excellent finished appearance as a result of using the material. Write **M & H Laboratories, 2705 Archer Avenue, Chicago 8, Ill.**

equipment tools materials

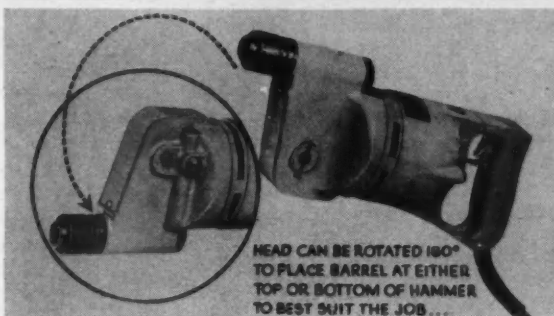


Sectional Bridging

Road finishing bridges pictured here are designed particularly for brooming, screeding and surfacing roadways, bridges and airport runways. Each scaffolding section is 12 feet long, 20 inches wide and 14 inches deep. Sections fasten together quickly to make free spans up to 60 feet long. Box girder construction eliminates side sway while reducing deflection to a minimum. This permits either side of scaffolding to be used by the workman, enabling him to reach any section of the slab. **Spartan Scaffolding Products, Inc., South Gate, Calif.**

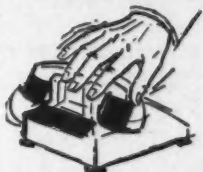
Electric Hammer

This 8½-pound electric hammer employs neoprene blocks to give extra snap to the 3,000 blows per minute delivered, and to eliminate vibration on both motor and operator. The head can be rotated 180 degrees to place barrel at either top or bottom of hammer to best suit the job. The tool can be held and operated with one hand on ladders or scaffolds. Forty-one tools and six chucks are available for a wide variety of jobs. **Super Slugger Company, 1020 Broadway, Bedford, Ohio.**



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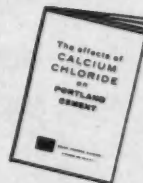
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equipment tools and materials



Power Tamper

This self-propelled power tamper for packing down backfill in trenches and around foundations and piers and for black-top paving and patching has an 18- or 24-inch wide shoe. Shock absorbing handles prevent transmission of fatiguing vibration. A heater attachment for the shoe eliminates sticking of black top. **Kelley Machine Division, 285 Hinman Avenue, Buffalo 23, N. Y.**

Mobile Radio System

Another step toward the wrist radio concept of communications has been accomplished in the Handie-Talkie Pocket Receiver, and accompanying Handie-Talkie Pocket Transmitter. The fully transistorized receiver makes possible the immediate contact of key personnel in any location. Communications can be maintained with the system's base station or any of its mobile stations. **Motorola, Inc., 4501 West Augusta Boulevard, Chicago 51, Ill.**

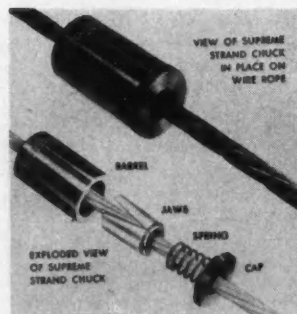


Floor Slab Ducts

This form for laying ducts for floor slab perimeter heating is said to insure complete encasing of the duct to a predetermined thickness, effect savings up to 50 percent in the amount of concrete used, prevent shifting of the duct while concrete is being poured and keep dirt out of the concrete. **Edward Associates, 515 Second Avenue, W., Seattle 99, Wash.**

Strand Chuck

A new chuck is said to overcome difficulties frequently found in devices for gripping wire rope. It is slid onto the strand and moved to the desired position without tools. The jaws automatically assume the proper grip. It withstands all tensions encountered in prestressing and is easy to remove and prepare for reuse. **Supreme Products Corporation, 2222 South Calumet Avenue, Chicago 16, Ill.**



equipment and tools

Flashing Material

A low-cost, concealed flashing material combining the strength and vermin resistance of aluminum and glass fibers with the flexibility and waterproofing qualities of asphalt-impregnated creped paper is designed for waterproofing, dampproofing, and verminproofing of residential and industrial buildings. It consists of aluminum sheet, bonded with plasticized asphalt to heavy creped kraft paper, and reinforced with glass fibers, spaced $\frac{1}{4}$ inch apart and running in both directions for maximum strength and tear resistance. It is available in widths from 4 to 48 inches in 120-foot rolls. Write **Chase Brass & Copper Company, Waterbury 20, Conn.**

Anchor Drill

A new anchor which is installed with a hand chuck and ordinary hammer is a fast-cutting hollow core drill that can be installed in two minutes in concrete, brick or stone and then becomes an anchor for a $\frac{1}{4}$ -inch bolt. Tests have shown that the anchoring device will hold a dead load of nearly 2 tons. Write **Phillips Drill Company, Michigan City, Ind.**

Concrete Vibrator

Weighing only 25 pounds, the new pistol-grip White Lightning concrete vibrator boasts a $\frac{3}{4}$ -horsepower motor that delivers maximum power to the vibrating head even at the end of a 24-foot drive shaft. A second advantage claimed by the manufacturer is the variety of drives and heads which can be attached quickly without the use of adapters. Write **White Manufacturing Company, Elkhart, Ind.**

Bridge Forms

Permanent, galvanized steel forms for concrete bridge decks are available in 20-, 18-, and 16-gauge thicknesses. The pitch of the corrugations is manufactured to fit the spacing of

the reinforcing steel used in a particular bridge deck. Thus the concrete that goes into the ribs also serves as cover for the reinforcing bars. These forms are the latest addition to a line of highway products which includes guard rail and pavement joints. The firm also manufactures steel products for floor and roof construction. Write **Granco Steel Products Company, 6506 North Broadway, St. Louis 15, Mo.**

Epoxy Toppings

Two new epoxy topping materials are used to guard concrete surfaces against chemicals and traffic wear. The troweling mix is recommended where resistance to chemicals and wear are needed and may be applied to either old or new concrete. Its thickness, texture, hardness, resilience and color can be varied to meet specific needs. The liquid material cures to a rough finish which is skidproof and since it can be applied by spray is less time-consuming to use where large areas are to be covered. Write **Hodges Chemical Company, Redwood City, Calif.**

Polyethylene Film

A lightweight polyethylene film covering offers permanent protection against moisture, dust, rot, mildew, and air penetration of buildings, according to the manufacturer. It can be used to shield all building materials and machinery from ravages of weather. The material is washable and reusable and is said to be pliable even in freezing weather. Write **Reliance Plastic and Chemical Corporation, 110 Kearney Street, Paterson 26, N. J.**

Joint Sealant

Cracks and joints in concrete, brick, metal or wood may be made permanently weathertight with Stonlast, a synthetic rubber compound which contains no oils. The secret of the material's long-lasting qualities, according to the manufacturer, is in its resiliency which enables it to give with expansion and stretch with contraction while strongly adhering to the base material. It does not shrink and is unaffected by temperature changes. Write **Stonhard Company, Inc., 1306 Spring Garden Street, Philadelphia 23, Pa.**

Dodson's Digest



Bridge Deal

As I headed home recently from an extended trip outstate, I stopped at a detour. A bridge construction crew was replacing old wood abutments with concrete so I decided to have a look.

"Hi!" I shouted, walking up. "Name's Dodson. What's up?"

"Hello," called a heavy-set man. "I'm Otto Molmen. We bid low on this job . . . too low, the way things are going."

"Sounds like trouble," I ventured. "How long you been on it?"

"Two weeks now . . . and we haven't even gotten a good start," he said, disgustedly. "What's your line?"

"Calcium Chloride," I answered. "Maybe I can help you."

"Now don't get me wrong, Dodson," he said firmly, "but if there's one thing I don't need, it's more expenses! Be lucky to break even."

"One way to cut costs is to get the job done sooner," I remarked.

"Right," he replied, "but . . ."

"Okay," I broke in. "With Calcium Chloride in your mix you'll save money. Not only will it reduce set time by more than half so you can finish up sooner, but it also minimizes chipping and cracking. With Calcium Chloride you get higher early and final strength, too. Now, if I were you, I'd . . ."

"Sounds logical," he interrupted. "I'll get some tomorrow."

"Nothing doing!" I insisted. "Get to a phone right now, and call your ready-mix man . . . tell him on the next truckload to add two pounds of Calcium Chloride for each sack of cement."

"What's the rush?" Otto asked.

"Oh, nothing," I grinned. "Only that I've got to make this trip again next month . . . and this bridge will save me 40 miles of driving!"

— L. D. DODSON

P.S.—If you want to bolster your cold weather profits, send for your free copy of our booklet, "How To Make Better Concrete Products and Ready Mix." **Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.**

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Literature

Diamond drilling equipment. For contractors, maintenance men and installers whose work involves cutting holes in reinforced concrete, tile, brick, marble, granite or other hard, brittle material, a new Truco catalog, SC-3, contains illustrations and specifications of Truco portable diamond drilling equipment and accessories. On-job photos and descriptions of difficult drilling situations show the equipment in use. Truco Masonry Drilling Division, Wheel Trueing Tool Company, 3200-252 West Davison Avenue, Detroit 38, Mich.

Industrial floors. How heavy duty industrial floors are finished or resurfaced with Cortland emery aggregate is described in an 8-page bulletin. Specifications for preparing base slabs, mixing Cortland emery and cement and placing the Emery-Crete mix for monolithic and granolithic finishes are given. How to prepare old concrete floors for resurfacing or patching is explained and information on curing and protecting new or refinished surfaces is included. Maintenance and cost factors are discussed. Bulletin 653 is available from Walter Maguire Company, Inc., 60 East 42nd Street, New York, N. Y.

Protecting stockpiles. A new water-base spray for protection of outdoor storage piles is described in a Bulletin, P58-1. Included are pictures and a description of the surface crust produced, and a description of the protection the compound provides. Nine typical materials and the recommended compound grades are listed. Other variations of the compound to meet specific conditions or materials are available as required. The Johnson-March Corporation, 1724 Chestnut Street, Philadelphia 3, Penna.

Prestress strand. A brochure describes the properties and characteristics of 7-wire high-strength stress-relieved strand for prestressed concrete. The publication contains typical stress-strain curves of 3/8- and 7/16-inch strand, the most popular sizes, to-

gether with data concerning breaking strength, yield strength at 1 percent elongation, ultimate elongation in 24 inches and typical elongation in 10 feet at recommended prestressing load. H. K. Porter Company, Inc., Leschen Wire Rope Division, 2727 Hamilton Avenue, St. Louis 12, Mo.

Air photo interpretation of soils. How air photo interpretation provides basic soils and geological data for the pre-boring stages of engineering projects is reported in a 4-page folder. The use of air photo studies to locate construction materials, determine trouble areas, aid route location and to investigate excavation and foundation problems is also discussed. Aero Service Corporation, 210 East Courtland Street, Philadelphia 20, Pa.

Rubber calk sealants. A 1958 catalogue contains up-to-date application and technical information on this firm's "Rubber Calk" and other construction sealants. This two-part polysulfide liquid polymer base material has found wide application in coping with curtain wall and tilt-up construction sealing problems. Products Research Company, 3126 Los Feliz Boulevard, Los Angeles, Calif.

Industrial protective clothing. A new 8-page catalog, No. 6300, illustrates and describes work suits, raincoats, storm suits, gloves and aprons used in industry. Accessories include Koroseal film sleeve protectors, rubber-coated leggings and hats. Charts make it easy to select garments according to weight, service, color and material — rubber, Koroseal, neoprene, Hycar. A special section is devoted to glove selection. B. F. Goodrich, Akron, Ohio.

Mobile radio equipment. A 16-page booklet, "Under the Influence of Radio," has been published as a guide for prospective users of mobile radio equipment. The booklet shows the numerous ways radio is useful to drivers of cars and trucks. Included is information on licenses for base stations, mobile units and drivers. Instructions concerning adjustments, maintenance and how to send messages are included. General Electric Communication Products Department, Electronics Park, Syracuse, N. Y.



...consider concrete reinforced with
WELDED WIRE FABRIC

Whenever construction calls for concrete, it usually pays to reinforce it with Welded Wire Fabric. Many contractors make extra sales to owners by carrying a few rolls of CF&I Clinton Welded Wire Fabric to the construction site. A short explanation of how Welded Wire Fabric substantially increases the life and appearance of concrete convinces many builders to choose reinforced concrete.

Concrete reinforced with Clinton Welded Wire Fabric has far greater strength than an unreinforced slab. It has higher resistance to the heaving, contrac-

tion and expansion caused by sudden temperature changes. If a crack should develop, the fabric holds it tightly in check, preventing moisture or earth from entering and expanding it.

Clinton Welded Wire Fabric is readily available, in all popular sizes and lengths in both the East and West. So, before you pour, consider reinforcing concrete with Clinton Welded Wire Fabric. The slight additional cost of reinforced concrete is more than offset by its longer life, more attractive appearance and minimum maintenance costs.

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WHEN THEY ASK...

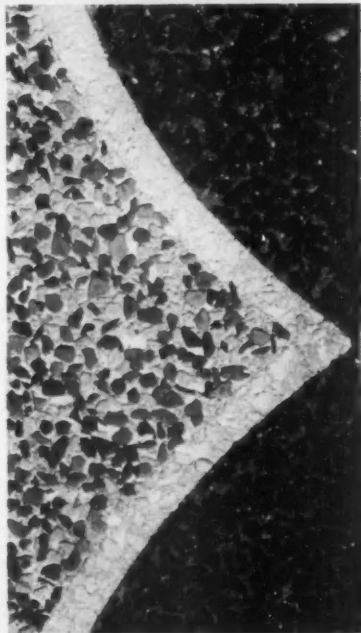
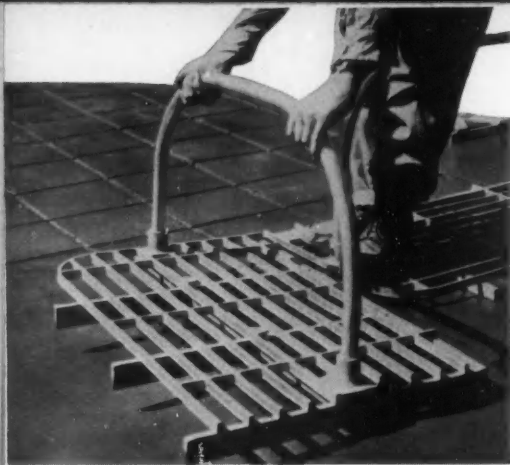
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Concretely Speaking . . .

THE VARIED FACES OF SITE-CAST CONCRETE

There are probably at least a thousand reasons for the growing popularity of site-cast concrete for every type of construction, but one of the basic reasons which we may sometimes lose sight of is the astonishing variety of surface treatments which can be achieved with this versatile material. They range from the ruggedly rough textures of large exposed aggregates to the glass-like smoothness achieved with the new plastic form liners. Then, too, design possibilities are practically unlimited. Whereas metal wall panels are confined to simple, straight line patterns, concrete can be formed into practically any of the free forms.

We're all familiar with burlap-drag and broom finishes. Square sections of form boards set in opposing directions lend interest to large otherwise unrelieved walls on many buildings. Marble and ceramic aggregates which add beauty and color to concrete can be obtained by rolling these materials into the surface or by the exposed aggregate or aggregate transfer techniques. These methods are used on walkways and streets as well as walls.

Form liners offer the means to innumerable other textures and designs. Plaster-of-paris waste molds can be used to form concrete into even the most intricate designs. Sand-blasted plywood imparts an appearance of wood to the surface, which can be further enhanced by staining the concrete dark brown. This is quite popular in resort areas where the fire hazard is great, but where the color and texture of wood is preferable on esthetic grounds. Rubber form liners produce a rug-like texture. Plastic form liners offer ultra-smoothness together with a ready adaptation to original designs. Very recently a textured cardboard form liner has been used with excellent results. Concrete has even been cast against polyethylene film placed over rocks to create an especially rough surface.

These are only a few of the integrally cast designs and textures available. These, together with applied treatments such as the new long-lasting plastic-based and epoxy paints, constitute some of the reasons why the ready mixed concrete we deliver to your construction site is the most versatile building material in the world today.

YOUR LOCAL PRODUCER OF READY-MIXED CONCRETE

